Committee Waste Effluents

OAK RIDGE NATIONAL LABORATORY

Intra-Laboratory Correspondence

August 31, 1960

TO: Waste Effluents Committee

RE: Minutes of Meeting Held on August 8, 1960

Present: Committee Members

W. H. Jordan, Chairman
E. Lamb
K. B. Brown
W. Y. Gissel
Lewis Nelson
F. Kertesz, Secretary

Operators

F. N. Case
J. A. Cox
E. J. Witkowski
J. R. Gissel
A. F. Rupp
K. E. Cowser

Discharge of Ruthenium to the Pits

Chairman Jordan announced that the previously set limitation of 50,000 curies discharge of ruthenium per year to the pits* appears to be acceptable to the Operations Division. The whole situation will be re-evaluated in light of future experience, especially when the now-proposed pilot plants of the Chemical Technology Division are in full-scale operation. It is hoped that use of holdup tanks for cooling and re-piping the streams whenever necessary will further alleviate this situation. Special attention will be given to any new problem which might release large amounts of ruthenium.

Rupp announced that a new trench will be dug soon, using the dirt removed from it to fill Pit No. 4. In Witkowski's opinion it would be preferable to await completion of the new trench before filling Pit No. 4.

Disposal of Solid Waste

Witkowski described the current procedure of handling solid radioactive waste which includes material both from the Laboratory and from the entire Eastern half of the U. S. Uranium waste and mildly contaminated materials should be sent to Idaho or should be disposed of locally in order to reduce the land consumption at ORNL.

Although Federal regulations allow shipment of materials having an activity up to 200 mr/hr at the surface of the package, many customers do not take advantage of this; rather than accumulating their waste or disposing it locally, they find it more convenient to send it to Oak Ridge.

The nature of the material is quite varied, ranging from laboratory glassware and paper to contaminated industrial equipment, building materials, etc.

* See Minutes of Meeting Held on June 27, 1960.

Up until now the preliminary arrangements were made by the Operations Division, while actual burial was performed by the Engineering and Mechanical Division staff. In view of the large amount of paperwork involved, the Isotopes Sales Section of the Isotopes Division recently took over these preliminary arrangements with outside customers, leaving the actual burial operations in the hands of the Engineering and Mechanical Division, under the supervision of J. Gissel, as before. Although the bulk of the work is of routine nature, some of the minor contributors are responsible for a considerable amount of paper work.

As a result of preliminary correspondence, the burial ground supervisors are made aware of the problems involving individual shipments. The answers to the questionnaire on the standard waste disposal form include volume, weight, isotopic distribution, estimate of activity, explosive nature, reactivity with water and bacteriological contamination. Past experience indicates that estimates of the activity are usually inaccurate. The total activity of the material received is about 200 curies/month.

In order to reduce the hazards involved in handling, materials must be packaged in non-returnable containers. Radium and cyclotron-produced isotopes are not accepted, although AEC contemplates changing this last restriction. Liquids must be converted into solids at the originating plant.

Organic material occasionally causes difficulties. If an insufficient amount of preservative is added, the container might become pressurized. Although the activity of the carcasses of experimental animals reaches only the microcurie level, they cause a problem because they are unpleasant to handle.

ORNL has had very good experience with all shipments; contamination or leakage have been noticed very rarely. Small customers who send only partial shipments are especially careful; major contributors have caused occasional slight contamination. Bulk shipments are made via railroad cars, while small shipments are made via truck. The vehicle is always decontaminated before it is released to the customer in cases where it is found to be contaminated. During transit the responsibility for the shipment lies with the customer who must follow ICC regulations. Steel or fiberboard drums are used as the preferred packaging material.

Before actual shipment, the customer must receive permission from ORNL to make it. Shipments which present a special hazard, such as evolution of gases in transit or the possibility of explosion during handling or after burial, are not accepted. The present strict regulations were set up as a result of an accident which occurred several years ago when a container filled with sodium exploded during the burial operation. This was before solid waste burial was organized.

Cowser reported that according to his measurement the activity migrates only very slightly. This is understandable as the material is solid when buried, and special care is taken to keep water away from it by burying above the highest level of the water table. After placing the material to be disposed in the trench the latter is filled with dirt and shale.

On the basis of his experience gained during the actual burial operations Gissel reported that no really serious problems were encountered in the past; he credited this to the excellent preliminary work.

With reference to the disposal of material originating in Oak Ridge, Gissel mentioned that the Y-12 Safety and Health Physics Groups cooperate fully with his office. They check each shipment sent for burial from that plant. In order to reduce personnel exposure, each truck involved in the handling of radioactive wastes is subjected to a field survey and is subsequently tagged with a notation of its exact activity level.

Most of the material originating at ORNL is dumped into the open trench from GI cans which are reuseable and cost less than the fiberboard containers. For carrying them to the site hot dumpsters are also used, in addition to a special shielded dumpster which carries material from the Isotopes Division. About 50% of the material by weight, and more than that by activity, originates at the Laboratory.

Rupp commented that although burial is convenient and an inexpensive way to eliminate undesirable activity, it would be preferable to install a grinder, an incinerator, and an ash extractor, after which the material would be mixed with concrete and disposed of. At present about five acres per year are used for burial activities.

Decision: The Committee reserved judgment until an inspection of the premises can be made.

FK:jd:pl

Submitted by Francois Kertesz

Francois Kertesz, Secretary
Waste Effluents Committee

Distribution

W. H. Jordan
W. A. Arnold
K. B. Brown
Eugene Lamb
Lewis Nelson
W. Y. Gissel
J. Gissel
F. Kertesz
F. N. Case
J. A. Cox
E. J. Witkowski
A. F. Rupp
K. E. Cowser
W. M. Stanley
C. D. Cagle
T. F. Connolly
F. R. Bruce (4)
C. E. Winters
A. M. Weinberg-J. A. Swartout

X-847

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

January 27, 1961

To: Alvin M. Weinberg

Subject: Annual Report of the Waste Effluents Committee

During the past year the Committee has been chiefly concerned with the disposal of liquid wastes at ORNL. We spent a great deal of time, probably too much time, on the disposal of intermediate-level wastes to the pits. We have urged that the present open pits be abandoned as quickly as possible and that the amount of wastes dumped into the ground be limited in quantity during any quarter. Largely through the efforts of Binford and Cowser, an upper limit has been established. During the past year, the situation has improved tremendously - however, there is considerable question as to how much was due to the actions of the Committee. A major crisis was averted by the shutting down of the pilot plants. I believe the trenches can be used for an extended period without undue risk, provided they are not overloaded and that the monitoring program is continued. Even so, I think it is important to get the evaporator installed - partly because of public relations rather than a real hazard, and partly because ORNL can then take on jobs that involve large quantities of radioactivity, such as pilot plant operations.

Many improvements have been made in the past year in the low-level disposal operations. Again, the Committee has supported the improvements but cannot claim much credit for them.

I do have reservations as to how valuable the Waste Effluents Committee is to you. At least during the past year, our influence has been small compared to the stimulating influence of the several incidents that have occurred. If the existence of the Committee were to mean that Frank Bruce were to relax his efforts in this area, the Committee's value might well be negative. Only continued vigilance on the part of the Operations Division can really be effective in reducing the number of accidental releases. To be 100% safe would be prohibitively expensive. Perhaps the Committee can be of some help in establishing the balance between safety and economy, but it cannot take the place of a continuous review.

Barring another incident, the first item of business for the coming year will be a review of the gaseous waste disposal system. This was not reviewed last year because of the large number of changes that were under way. Following that, a brief review of liquid and solid disposal operations will be undertaken.

W H Jordan

W. H. Jordan

WHJ:dwh

cc: F. R. Bruce
F. Kertesz

X-847

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

January 17, 1961

To: G. C. Cain

Subject: Membership in the Laboratory Director's Review Committees

As you are probably aware, ORNL has several review committees which concern themselves with the safety of specific phases of the Laboratory's operations.

I would like to ask you to serve as a member of the Waste Effluents Committee for a term concluding at the end of 1962.

Further information concerning the activities of the Committee may be obtained from its chairman, W. H. Jordan, or the Executive Secretary of the Laboratory Director's Review Committees, F. Kertesz.

F. R. Bruce
Director
Radiation Safety and Control

FRB:FK:bMcH

cc: A. M. Weinberg-J. A. Swartout
M. E. Ramsey
W. H. Jordan
F. Kertesz
File

ChemRisk Document No. 2374 (3 of 12)

Committee - Jan 7/11
Waste Effluents

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: May 26, 1961 **Code Number:**

Present: W. H. Jordan, Chairman
W. A. Arnold
N. C. Bradley
K. B. Brown
F. R. Bruce
F. Kertesz
E. E. Lamb
A. M. Weinberg

Weinberg announced that the purpose of this meeting is to give an opportunity to Committee members for expressing opinions and for presenting suggestions.

Jordan reviewed the past activities of the Committee. During the last year the liquid and solid waste disposal practices of the Laboratory were examined critically; plans for this year include discussion of the waste disposal philosophy and collection of the criteria. The Committee also intends to review the current waste disposal operations of the Laboratory on a continuing basis and to formulate an opinion on the proposed plans.

A large portion of the Committee's time during 1960 was taken up with the discussion of the operation of waste pits. As a result of these discussions in which several outside groups, including Operations Division personnel, were involved a limit of the activity which may be disposed of in this manner has been recommended. This represents an improvement over the previous situation during which the Operations Division had to accept anything that was dumped into the system without being able to point to an offically sanctioned limitation.

Although establishment of this figure which was actually met subsequently may be considered as a significant accomplishment of the Committee, this was possible only because the pilot plant operations have been shut down; otherwise possibly it would have been exceeded. It is quite probable that the MPC would have been exceeded except for budgetary limitations placed on several chemical operations which resulted in the reduction of the activity dumped into the river.

In its final report the Committee recommended to abandon the present waste pits as fast as conveniently feasible and supported proposals to construct trenches rather than new open pits.

A review of the solid waste burial practice showed that only a negligible amount of activity reaches the water from this source; however, it was pointed out that being the only area for disposing of the solid radioactive waste in the whole eastern part of the country uses up about 5 acres of ground per year, removing it from profitable service. In the long range it would be desirable if the Laboratory would not be involved in the waste disposal operations for other installations. Although the question was not examined in detail by the Committee, disposal of solid waste in salt mines appeared to be less expensive than burial. Studies are underway at the present time on the possibility of packaging the ORNL waste and on the use of incinerators to reduce the bulk of the material to be disposed of.

Bruce felt that an answer should be found to the question to what extent should the Laboratory be allowed to contaminate the environment. The code published in the Federal Register is quite explicit in setting forth requirements for licensees: the activity of the gaseous and liquid waste originating from the licensees' facility should not exceed one-tenth of the maximum permissible occupational concentration. Although this regulation does not apply to ORNL, the Laboratory should make all the effort to develop a capacity for complying with this requirement. At times the activity of the liquid waste was near the limit, e.g. on one occasion the activity of the Tennessee River at Chattanooga reached such a level that for a few days it could not be used for the manufacture of cellulose acetate for photographic film base. In addition, evidence collected by S. I. Auerbach indicates that the activity of the river fish occasionally approaches MPC. This situation should be improved by careful planning of new facilities.

Although the last year's situation was quite acceptable and the MPC was not exceeded any month in the Clinch River, certain short-time contamination incidents did occur. At present, the activity in the Clinch River water is between 20 and 30% of MPC; the 30% level was exceeded only once, during the month of February when the river flow was greatly reduced. Since the Operations Divisions request of not purging the canal waste water has been complied with, the concentration was reduced by a factor of about five. In the future ion exchange columns will be installed on all the canals. Credit should be given also to the great improvement of the process waste system.

While the pits are in principle undesirable it should be pointed out that the activity released by them consists primarily of ruthenium.

Installation of the stack monitors and the liquid waste monitors reassured management that the situation is not serious at present. Plans are readied for installing automatic proportional sampling stations.

During the past year the Committee requested detailed information concerning the "budgeting" of the waste determining the exact source of all the contamination factors. It was found that the pits contribute 20 to 30% of MPC, half of which is ruthenium.

Plans to remove the shale which contains the strontium could not be executed in view of the high activity of the soil; however, the radioactive isotopes contained in the shale might be leached out even if the pits are not used any more and they represent a potential hazard. The depth of the penetration of isotopes into this soil is not known exactly at present because financial and technical obstacles

TX-2703 (1-61)

prevented digging additional wells. It is known, however, that practically all the strontium is retained within a few feet. A land slide after a heavy rain would be a major catastrophe because the soil particles with the radioactive materials would be washed into the river causing a serious contamination. FRB

The Committee's immediate plans involve a review of the stack monitoring system and a study of the more recent liquid waste disposal methods.

Submitted by Francois Kertesz

Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

July 3, 1961

FK:bMcH

Distribution:
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
N. C. Bradley
K. B. Brown
F. R. Bruce
G. C. Cain
T. F. Connolly
J. A. Cox
J. C. Hart (4)
T. W. Hungerford
W. H. Jordan
F. Kertesz
E. E. Lamb
M. L. Nelson
J. A. Swartout
A. M. Weinberg
C. E. Winters
E. J. Witkowski

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

February 8, 19[illegible]

To: W. de Laguna

Re: Review of F. T. Binford's CF Memo for Reactor Safety Journal

I feel that it is not proper to review an article for the Journal when that article is not available to the reader. Binford's memo was given limited internal distribution. It was written to answer the question - how much activity can be put into the pits without exceeding 30% MPC? It is not Laboratory policy to put as much as possible into the pits. We are preparing to spend large sums of money to get out of the pit business - in other words, to do what you feel is proper.

If Binford wishes to write an article on the limits of pit disposal, he may do so. A review of that article would then be entirely proper. I would also say that if you wish to write an article on the proper use of the environment for waste disposal and refer to published data, I think you would have a good paper.

I admit this is a sensitive subject just now. We have been criticized for our past practices and I won't try to justify them. However, we are trying to mend our ways and I would rather not see the boat rocked at the moment.

I am sorry to ask you to withhold publication of the review paper. You have put a lot of work into it and I can't disagree with your point of view.

W. H. Jordan

WHJ:[illegible]

cc: F. T. Binford
W. B. Cottrell

bc: E. G. Struxness
J. A. Swartout

Committee
Waste Effluents

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

August 3, 1961

CR

To: F. R. Bruce
W. H. Jordan

Re: Minutes of Waste Effluents Committee
Meeting, June 19

I had not realized that the Tennessee River at Chattanooga has a higher burden of activity than any other large river. This is too vulnerable a spot for comfort. What gives?

ORIGINAL SIGNED BY
ALVIN M. WEINBERG
Alvin M. Weinberg

c

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: June 19, 1961 **Code Number:**

Present: W. H. Jordan, Chairman
H. H. Abee
W. A. Arnold
J. O. Blomeke
F. R. Bruce
G. C. Cain
D. M. Davis
E. Lamb
M. L. Nelson
F. Kertesz, Secretary

Chairman Jordan summarized the program of the Committee for the year as follows:

1. To get acquainted with the proposed standards and criteria for waste disposal and suggest changes whenever deemed necessary; and

2. To make sure that the standards agreed upon are actually met.

Bruce described the currently applied principles for disposing of radioactive waste at the Laboratory. The primary aim is to improve the present waste disposal methods, ensuring acceptable activity levels without setting the standards so high that it will interfere with the operations of the various facilities. The Laboratory must have the ability to control the environmental contamination resulting from operating the various facilities; as an upper limit, the most liberal interpretation of rulings which must be observed by AEC contractors should never be exceeded. In order to reach this aim, facilities such as the waste disposal pits which are deemed to be unsatisfactory will be eliminated and replaced with acceptable new ones.

On the basis of legal requirements now in force, the Laboratory would exceed the upper limit if it continues to take advantage of the dilution by the Clinch River for reaching the one-tenth MPC. The aim is to limit the activity of the waste to one-tenth of MPC at the point of discharge in view of the general rule that the population at large must not be exposed to more than one-tenth of the occupational MPC when it leaves the Laboratory's control.

In order to reach this goal, it is planned to acquire the ability of operating under the same ground rules as the licensees. At present the contamination of the Clinch River is a potential source of embarrassment to the Laboratory. A review shows that the contamination at Chattanooga is the highest of all the major rivers of the country although the Savannah River plant and Hanford handle larger amounts of activity. Up to now there was no reaction to this fact but the public relations problem must always be considered.

During the winter months the discharge of water from Norris Dam is quite low resulting in a decreased dilution; in addition, with the construction of the Melton Dam the traffic will be increased at the discharge point. There are also indications that certain types of river fish concentrate the activity.

In order to lower the activity levels, several steps have already been taken while others are in the course of execution: abandonment of the open pits, preparation of waste disposal trenches, construction of storage vessels, and in the near future processing of the waste.

It should be emphasized that the present situation is not unfavorable. During the last year the activity of the process waste was considerably decreased; of course, this is due in part to the fact that the pilot plants have been closed down. Considerable improvement resulted from elimination of the practice of purging storage canals into the waste system. Present plans include the construction of an ion-exchange system at each canal, recirculating the water over the resin bed. From extrapolation of data for the first quarter of 1961 it is expected that the activity released during the rest of the year will reach only 40 curies; on the basis of April data alone the situation is even more favorable. After the ion-exchange columns and monitoring stations are installed the activity will be even further decreased.

The flow rate in White Oak Creek is about 1,000,000 gallons per day, half of which originates from ORNL. The activity of this water is between 0.02 and 0.04 microcuries/gallon being due mostly to cesium which does not present a serious problem.

Results show that with relatively minor effort the waste situation can be considerably improved. It is not proposed at present to achieve the one-tenth MPC at discharge point with all the old facilities but to await the issuance of new regulations. On the other hand, new facilities will have such a built-in additional capacity and the above-mentioned ion-exchange column and monitoring stations will result in further improvements.

In comparing the situation at various sites the local circumstances must always be taken into consideration. Hanford Works has the advantage of having a large river to dilute its waste effluents. Total body counts of the Hanford personnel occasionally show a high Zn-56. Great differences may be allowed between sites, depending whether well water or river water is used for drinking. Sea animals, such as oysters, may enrich certain radioactive isotopes. The river water at the Savannah River Plant is only slightly contaminated in spite of the large amounts of radioactive isotopes handled. On the basis of available data it is found that ORNL is in the same category as Hanford Works but did not reach yet the more satisfactory level of the Savannah River Plant and therefore some of the operations must be carefully reviewed.

The improvement due to the elimination of the pits and of canal purging and storage of the waste in tanks will pass through three phases: (1) At present one trench is in operation and half of the water still goes to the pits. The second trench will be completed by August of this year at which time all high and intermediate level waste will be sent to the trenches while the pits will be filled and covered with asphalt. (2) The trenches will be used until the new system is completed. This system is already approved and should be ready in about two years at which time the use of the trenches will be discontinued. The only possible alternate to the use of trenches during this period is to shut down the Laboratory completely. (3) Upgrading of the overall system including special solutions such as the diversion of part of the Melton

TX-2703 (1-61)

Hill lake through a cut which would result in a negligible loss of the electricity generation. A flow rate of 500 cfs, which is one-tenth of the Clinch River flow, would result in an increased flow of the waste effluents thus providing better dilution and eliminating precipitation in the river bed. The higher flow rate would also reduce the background level. At present the mixing is quite good by the time the water reaches the ORGDP.

In summary, it is hoped that in five to ten years the Laboratory will operate at the same level as the licensees. In the meantime the present facilities will be used, providing the necessary improvements.

Arnold pointed out that occasionally the water flow might be reduced or even stopped in order to provide the required depth for navigation.

The Committee expressed satisfaction with the proposals.

Submitted by François Kertesz
Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

July 27, 1961

FK:bMcH

Distribution:
H. H. Abee
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
J. O. Blomeke
K. B. Brown
F. R. Bruce
G. C. Cain
T. F. Connolly
J. A. Cox
D. M. Davis
J. C. Hart (4)
T. W. Hungerford
W. H. Jordan
F. Kertesz
E. Lamb
M. L. Nelson
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

7/11/61

~~FRB~~

Frank

Please note page 3 - this continues to haunt us. What back-up can be provided to reduce consequences of such a slide?

Jas

Committee
Waste Effluents

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: July 10, 1961 **Code Number:**

Present:

Members	Experimenters or Operators
W. H. Jordan, Chairman	T. A. Arehart
W. A. Arnold	J. O. Blomeke
K. B. Brown	F. N. Browder
F. Kertesz	F. E. Harrington
E. Lamb	H. O. Weeren
M. L. Nelson	E. J. Witkowski
D. Phillips (Substitute)	

Proposed New Liquid Radioactive Waste Facilities for ORNL

Blomeke briefly described the Chemical Technology Division program of studies and designs aimed at achieving the recently stated management objective of creating the potential for maintaining environmental MPC specifications for radionuclides in liquid waste discharged at White Oak Dam. The established environmental (in the neighborhood of an atomic energy plant) MPC value for identified mixed fission products is 10^{-7} microcuries per milliliter, which is one-tenth of the occupational value.

Studies have been in progress for some time on three phases of ORNL liquid waste management: (1) the design of cooled storage tanks for high radioactivity level waste; (2) the design of an evaporator for intermediate-level waste, and (3) laboratory and small pilot plant development of an ion-exchange treatment process for low-level (process) waste. A comparative study on various treatment techniques for low-level waste has also been in progress, but no final decision has been reached on the selection of a treatment process.

A sum of about $1.7 million has been earmarked for constructing high-level waste storage tanks, an intermediate-level evaporator and Melton Valley waste collection systems for low- and intermediate-level wastes. The budget does not provide for treating low-level waste. It is expected that by reducing the radioactivity level of material discharged by individual contributors the need for an expensive low-level waste treatment plant may be reduced.

Weeren described proposed changes to the ORNL high- and intermediate-level waste systems. At the present time high-level waste is neutralized and collected in catch tanks before being transferred to the concrete storage tanks in the tank farm, which also receives neutralized intermediate-level waste. It is proposed to collect high-level waste in its normally acid state and to store it in two 50,000 gallon stainless steel tanks provided with external cooling coils. Submerged jets will be provided in these 12 ft diameter by 60 ft long horizontal tanks to allow recovery of fission products and/or evaporation of this waste. High-level waste may be sent directly from the existing catch tanks to the intermediate-level evaporator if further concentration is feasible. High-level waste will normally contain about 700 curies per gallon, but shielding (5 ft of concrete) of the high-level storage tanks and of the intermediate-level evaporator is designed to handle 2,000 curies per gallon. It is proposed to maintain one high-level storage tank as a spare to receive the contents of the other in the event of tank failure.

The high-level storage tanks will be placed in underground cells located near the existing tank farm. The tanks will normally be cooled by non-recirculated water through external coils welded to the tanks. In the event of cooling system failure, the stored waste should reach an equilibrium temperature below the boiling point by loss of heat to the cell off-gas system. An emergency reflux condenser will be provided in the vessel off-gas system to prevent overloading this system with vapor from 2,000-curie-per-gallon waste in the event of tank coil failure. The vessel off-gas will be processed by caustic scrubbing and filtration before release to the 3039 vessel off-gas system. The vessel off-gas equipment will be located in a cell shielded with two feet of concrete adjacent to the storage tank cells.

The 600-gallon-per-hour intermediate-level evaporator, a vessel about 10 ft in diameter by 12 ft high with internal steam coils, will serve mainly to concentrate intermediate-level alkaline wastes (10^{-5} to 10 curies per gallon), which will continue to be received in one of the concrete tank farm tanks from smaller stainless steel catch tanks at various sites in the main X-10 and Melton Valley areas. This type evaporator was selected in preference to either the external tube chest or the vapor compression types because of its greater simplicity and lower capital cost. It will be installed with an evaporator feed tank in an underground cell equipped with removeable roof plugs, shielded with five feet of concrete, and located adjacent to the high-level storage tank cells. The vapor from the evaporator will be condensed, monitored, and sent to process waste, while the concentrate will be returned to the concrete tank farm for storage. The condenser and condensate catch tank will be located in a cell shielded with three feet of concrete. The condenser cooling water will be recirculated through an air-cooled heat exchanger outside the shielded area for heat removal. The vessel off-gas will be processed in the same equipment used for the high-level storage tank vessel off-gas. The cell off-gas will be filtered before release to the 3039 cell off-gas system.

The evaporator will be equipped with an impingement-type deentrainer followed by a metal mesh filter for the removal of particulates from the overhead vapors before they reach the condenser. Heat loss from the filter should be great enough to condense 1 to 2% of the vapor, thus providing a continuous wash-down of the mesh to prevent solids build-up. Spray nozzles will be provided to remedy plugging of the mesh, which can be replaced when necessary. No trouble has been experienced with a similar system at Brookhaven National Laboratory, where decontamination factors greater than 10^3 have been obtained over the filter alone. Overall decontamination of feed to vapor is expected to be greater than 10^6.

The capital cost of the evaporator and storage tank installation is estimated to be about $1.3 million and should require about $134,000 per year operating cost. This proposal is described in detail in ORNL-CF-61-5-22.

Studies of ORNL Low-Level Waste Treatment and Disposal Proposals

Browder used a number of charts and diagrams to present the current status of low-level waste treatment and disposal methods, the effect of ORNL radioactive waste discharges on the Clinch River, and a comparison of several proposals for correcting difficulties with low-level waste management at ORNL.

The data presented in Table 1 show the calculated activity levels of the river expressed as percent of MPC_w (10^{-7} microcuries/cc) over the past several years. This information came from Operations Division and Health Physics Division reports. The average values per quarter vary from 11 to 84% of MPC. Occasionally, the prescribed value has been exceeded for short periods; in one week in 1959, activity reached 683% and recently was 102% of MPC. Although the environmental MPC (one-tenth of the occupational MPC) was never exceeded for a whole quarter, the margin of safety is not comfortable.

Table 1. Clinch River Monitoring Data

	% MPC_w in River (Calculated)	
Quarter	Ave. for Quarter	Highest Weekly Discharge
1st 1961	33	102
4th 1960	22	176
3rd 1960	13	60
2nd 1960	23	93
1st 1960	31	103
4th 1959	11	42
3rd 1959	13	45
2nd 1959	44	159
1st 1959	84	683
4th 1958	48	400
3rd 1958	80	240

Table 2 lists the four sources of radioactive discharges into White Oak Creek from ORNL and the monthly amounts of radioactivity discharged from each in the first part of 1961. If the Laboratory is to achieve the stated goal of environmental MPC levels at White Oak Dam, a considerable reduction in activity discharged from every one of these sources must be achieved. The average flow of water at the dam, including natural creek flow plus waste water from ORNL, is about 12 million gallons per day, which will permit about 0.005 weighted curies per day or 0.150 weighted curies per month to be discharged from all sources if the 10^{-7} microcuries per cc

MPC level is to be achieved. Although the curies of activity listed in Table 2 are not weighed for MPC evaluation, it is apparent that the range of 171 to 601 total curies per month must be substantially reduced.

The process waste activity will be discussed later in this report. The burial ground activity discharges listed in Table 2 are apparently high, as monitoring wells in the solid waste burial grounds have not indicated such levels. A portion of the 10.3 and 1.9 curies per month listed through April was arrived at by difference between the activity measured in daily grab samples from White Oak Creek just upstream of its confluence with Melton Branch and that measured by continuously collected samples from the settling basin, where the process waste values were obtained. The accuracy of radioactivity discharge measurements should be greatly improved by the recent (May 1961) installation at several points in White Oak Creek and Melton Branch of monitoring stations that take continuous samples proportional to the stream flow.

Table 2. Curies Discharged from ORNL Operations

	Ave/Mo 1st Qtr	April 1961	May 1961
Process Waste	3.3	1.6	1.5
Burial Grounds	10.3	1.9	0
Melton Valley	0.7	2.0	1.3
Waste Pits	587.0	166.0	560.0
Total	601.0	171.0	563.0
W.O. Dam to River	283.0	220.0	195.0

The Melton Valley activity in Table 2 came primarily from the HRT, but soon five new research installations to be built there will be potential sources. The proposed Melton Valley waste collection systems should adequately handle this area.

The relatively large quantities of activity discharged into the creek from the waste pits should be reduced drastically after the proposed intermediate-level waste evaporator and the high-level waste storage tanks are installed. After that, no more activity should be put into the waste pits, which then can be immobilized. The activity discharged from the waste pits is predominantly ruthenium, a biologically less hazardous fission product, which makes the curies from the waste pits carry less significance in the calculation of MPC values.

The April total of 171 curies from all ORNL sources (measured by the Operations Division) is less than the 220 curies that passed from White Oak Dam into the river (measured by the Health Physics Division), while the reverse is true for the first quarter and the May figures in Table 2. This phenomenon occurs frequently and appears to be caused by alternate retention and release of activity in the basin mud behind the dam. Data collected over the past seven years indicate that 424 more curies of strontium passed the dam and into the river during this period than was put into the creek from all Laboratory sources. This brings up the old argument of how much previously released activity is now held up in the basin mud behind the dam. It has been suggested that differences in analytical techniques might explain the discrepancy; however; the fact remains that the level of radioactivity in the Clinch River rises with good correlation to heavy rainfall and creek flow, which tend to scour the basin mud and to sweep it into the river. Also, Chattanooga downstream from ORNL, has the highest strontium-90 content in its raw drinking water taken from the Tennessee River than any metropolitan area in the United States. These factors indicate a considerable quantity of activity retained in the basin mud, but a proposed bypass channel around the basin and dam has not been agreed upon (see Item 2, Table 3).

About one-half of the activity in process waste discharges is usually strontium-90, which makes this waste highly significant in MPC calculations. This means that the 1961 discharges of 1.3 to 3.3 curies per month in process waste alone, although among the lowest in the history of ORNL, exceeded the goal of 0.150 curies per month at White Oak Dam by factors of 10 to 20. When one considers that this 0.150 curies per month includes activity from <u>all</u> <u>four</u> sources shown in Table 2, it becomes clear what an extremely conservative goal has been set for the Laboratory. In addition, it should be mentioned that the 1961 discharges listed for process waste in Table 2 occurred under favorable conditions at the Laboratory: the canals were not purged during this period; the total volume of process waste was quite low; the major contributors at Building 3019, the Metal Recovery Building, and the Fission Products Pilot Plant were shut down; and no incidents occurred.

Where does the activity in process waste come from? The sources of process waste are listed in the table, ORNL-LR-Dwg. 59034, which shows that the largest volume of this waste (cooling water) is not normally contaminated, while the smaller volumes in items 2, 4, 5, and 6 are likely to be contaminated. The dual role played by this waste system, viz. as an emergency system to handle large volumes of contaminated cooling water and a system for handling low-activity waste, makes process waste a difficult problem to manage.

The major difficulties in the process waste system are listed in the table, ORNL-LR-Dwg. 59035, and the correspondingly numbered proposals for correcting these difficulties are listed and discussed briefly in Table 3. The first two proposals in Table 3 have already been agreed upon and are in the construction stage. Proposal No. 3, recirculation of condenser cooling water, has been abandoned for Buildings 3019 and 3505 because of curtailment of high-activity level processing in these buildings, but a chilled water recirculation system has been installed in Building 3517 (F3P) at a cost of about $175,000. During the latter part of 1960 and early 1961, the average volume of process waste has been reduced from the 10 year average of 685,000 gallons per day to about 400,000 gallons per day. This reduction was achieved by the Building 3517 recirculation system, the shutdown of Buildings 3019 and 3505 and by careful management of the system. However, the daily volume should rise to above 500,000 gallons per day when the new 4500 area research facilities come into use or whenever processing resumes in Buildings 3019 and 3505. The new Melton Valley reactors and processing plants may further increase the volume of process waste to be treated.

Item 4 in Table 3, the installation of small demineralizers, is scheduled for the Graphite Reactor Canal in 1961. The Metal Recovery Canal is to be emptied of fuel stored in it and to be cleaned in order to remove it as a source of activity discharges into the process waste system. These steps should improve the problem of deliberate routine discharges of activity.

Items 5 through 10 in Table 3 are all proposals to relieve the difficulties with the existing lime-soda process waste treatment plant (Item 5 in the table, ORNL-LR-Dwg. 59035). Although no decision has been made to adopt any of these proposals, the addition of effluent clarification steps to the lime-soda plant (Item 6, Table 3) is being investigated by the Health Physics and Operations Division, and ion exchange treatment (Item 9, Table 3) is being investigated in the Chemical Technology Division. While these investigations are being made, the proposals already put into effect (Items 1, 2, 3, and 4 of Table 3) should give an indication of how near an approach to the goal of environmental MPC at White Oak Dam can be made without major changes in or replacement of the process waste treatment plant.

Item 10 of Table 3 was investigated by the Chemical Technology Division. While there are many advantages to this total recirculation proposal, it does not appear practical for ORNL because only about 20% of ORNL process water reaches the process waste system. Rearrangement of the process water piping to accommodate this total recirculation proposal would probably be too expensive to justify.

Item 11 in Table 3 has already been discussed above.

The Melton Valley Waste Collection Systems

The report to the Committee on plans for constructing waste collection systems in Melton Valley was originally scheduled for the July 10 meeting but was postponed until the July 24 meeting because of the time consumed on the other reports.

Browder presented the Melton Valley proposals, which have been described in detail in ORNL-CF-61-5-24 with a supplement No. 1. Five installations will be served by the new waste collection systems: HFIR, TRU, MSR, the U-233 Facility and the HRT site. The Fast Burst Reactor will probably not be added to this list because of its distance from the others.

A low-level and an intermediate-level liquid waste system are planned. For the former, a collection pond for each installation except the MSRE is planned. The HFIR Pond No. 2, already in the design stage, is well located to serve as the central collection pond from the individual installation ponds, and permission has been granted to use it for this purpose. The MSRE designers plan to install a 13,000 gallon stainless steel tank rather than a pond for liquid waste. The plan is to connect the pumps serving this tank into both the low-level and intermediate-level systems and to discharge the waste to the appropriate system, depending on the nature of the tank contents. The HRT site already has a pond and needs only pumps and pipes to connect it into the low-level collection system.

Unclassified
ORNL-LR-DWG-59034

Sources of ORNL Process Waste

1. Cooling water from equipment handling radioactive solutions;
2. Waste from floor drains in areas where radioactive materials are handled;
3. Waste from "cold" sinks in all laboratories, even those handling no radioactivity;
4. Discharges of low-radioactivity solutions from cell and equipment decontamination;
5. Canal purges and overflows;
6. Drainage from monitoring pads and soil around "hot" waste tanks.

Unclassified
ORNL-LR-DWG-59035

Major Process Waste Problems at ORNL

1. Existing monitoring system is inadequate to determine waste flow from major sources or to warn of radioactive surges;
2. Facilities for emergency impoundment of excessively contaminated waste are practically non-existent;
3. The volume of process waste water is larger than necessary, making treatment of the total flow difficult;
4. Deliberate, routine discharges of radioactivity to the process waste system contribute too much contamination;
5. The existing treatment plant is too small for the normal waste flow and is not effective enough to remove over 85% of gross beta activity.

Table 3. Summary of Proposals for Improving the ORNL Process Waste Water System

	Proposals	Estimated Cost	Remarks
1.	Expanding and improving continuous monitoring system	$ 201,000	Work is in progress. Needed to warn of excess radioactivity in the waste and to locate sources of such activity.
2.	Construction of emergency impoundment facilities including pumps and pipe lines to waste disposal area	168,000	Needed to handle occasional high radioactivity levels in process waste water. Construction has started on a 3 x 10^6 gal basin, but plan being followed will not provide emergency impoundment for Melton Valley facilities or for waste pits.
3.	Reducing process waste water flow by recirculating condenser cooling water in Bldgs. ~~3019~~, ~~3505~~, and 3517	227,000	Would allow 500,000 gal/day plant to treat normal flow of process waste water except during occasional high radioactivity levels.
4.	Installing small demineralizers on Bldgs. 3001 and ~~3505~~ canals and recirculating canal water	70,000	Would reduce routine radioactivity in process waste water by 50% and should improve lime-soda plant D.F. proportionally.
5.	Doubling the capacity of the lime-soda treatment plant	200,000	Would allow treatment of full process waste water flow (10^6 gal/day) at D.F. = 8 except during occasional high radioactivity levels.
6.	Adding effluent clarification steps to existing lime-soda plant	Undetermined	Would increase D.F. to 20 on 500,000 gal/day except when complexing agents interfere or low temperatures affect calcium precipitation.
7.	Installing soil column to treat process waste water	Undetermined	Impractical even for 500,000 gal/day flow because of very large area required but promising as means of handling concentrated waste from a treatment plant.
8.	Installing evaporator to treat process waste water	$1,500,000	Would treat 750,000 gal/day at D.F. = 10^5 and cost of <$1.50 per 1000 gal; acid evaporation should give volume reduction factor of 10^3: expensive but very effective.

Table 3. Summary of Proposals for Improving the ORNL Process Waste Water System (continued)

	Proposals	Estimated Cost	Remarks
9.	Installing ion exchange equipment to heat process waste water	$ 500,000	Would treat 750,000 gal/day at overall D.F. = 10^2 and Sr D.F. = 10^3; cost of $0.66 per 1000 gal; unaffected by complexing agents in waste;
10.	Recirculating the effluent from a process waste water treatment as process water	460,000	Would reduce ORNL water usage and would reduce load on treatment process by reduction in dissolved solids from natural hardness in process water; careful control required to minimize chance of contaminating process water supply system; development program to test feasibility would be required.
11.	Construction of a bypass around White Oak Dam and lake bed to carry the normal flow of the creek	$65,000 for canal and diversion gate; (plus $71,000 for earth dam if more elaborate system is desired)	Would allow the 30 x 10^6 gal basin behind the dam to be used for emergency impoundment for both Bethel Valley and Melton Valley wastes; would provide secondary containment for the existing waste pits; would allow controlled release of old radioactivity in mud of creek bed.

As a general rule, the volume of low-level waste from Melton Valley facilities will be kept relatively low by recirculating most process cooling water. The TRU and U-233 facilities will make use of the HFIR secondary coolant and cooling tower to satisfy most of their requirements. Low-level waste will flow by gravity to the ponds and will be monitored upstream of each pond. When activity is detected, the monitor will simultaneously shut off the discharge from the pond and divert the inflow to the HFIR Pond No. 2, from which the contaminated waste can be pumped either to the treatment plant in Bethel Valley or to the emergency impoundment basin in lower Melton Valley. The continuous monitors will not reliably detect below about 100 times the environmental MPC value, so some activity can escape. It is planned to sample the waste continuously to supplement the monitoring. From a pumping station near HFIR Pond No. 2 contaminated low-level waste will be pumped through a 6-in. diameter cast iron pipe to a point near the White Oak Creek gap in Haw Ridge, where it will connect into the recently installed 6-in. line between the settling basin and the emergency impoundment basin now under construction.

Intermediate-level waste will be collected in a stainless steel tank at each Melton Valley installation. Two pumps will be provided at each collection tank for transferring the waste through a 2-in. cast iron pipe to a central collection station. An individual pipe line will be provided for each installation to avoid valving. Two 15,000 gallon stainless tanks will be provided at the central collection station, from which the waste will be pumped through a 3-in. cast iron pipe to the White Oak Creek gap in Haw Ridge, where it will connect to the recently installed 3-in. line from the Bethel Valley tank farm to the waste pits.

Hazards Discussed and Safeguards Suggested

What is the main source of the high-level waste?

> The fission products pilot plant is the chief contributor to the high-level waste.

What is the cut-off point between the high- and medium-level waste materials?

> The necessity of cooling is the criterion for considering a waste effluent as belonging to the high-level system; in general, this corresponds to activities higher than 10 curie/gal.

Are the waste streams neutralized?

> The intermediate-level is neutralized, but the high-level waste will not be.

What decontamination factors will be obtained?

> Factors ranging between 10^6 and 10^7 are anticipated.

Is there enough vessel off-gas capacity for taking care of the proposed high-level handling installations (evaporator system and the high-level waste tanks)?

There is sufficient capacity available now in view of the fact that the metal recovery operations with a capacity of 300 cfm will be discontinued.

Is there a source of emergency power available?

No, in case of accidents the evaporator will be shut down.

What was the longest period of water failure in the past?

There has never been a complete water failure in the history of the Laboratory.

How much holdup capacity does the intermediate-level waste system possess?

This corresponds to the capacity of the concrete tanks, namely 600,000 gallons or about three months. This capacity is reduced as the tanks are filled up.

What protection is available should the concrete tanks fail?

The streams would be drained into the equalization basin which feeds the waste treatment plant. This is a sufficient safeguard for a slight leak but is not acceptable for the sudden release of large amounts of waste liquids in which case the stored waste must be transferred to another tank. The system does not offer full protection in case of very serious damage due to an act of God, such as an earthquake.

What is the lifetime of the new tanks?

The exact service life of the tanks cannot be predicted as it is not known at this time what will be stored in them. They are planned for about 5 to 10 years and will be used to store only the highest level waste.

Why was extra capacity provided?

It is economical to store the waste and evaporate it at a time when the steam costs are lower; in addition the availability of the extra capacity should improve the Laboratory's competitive position in attracting new radiochemical programs.

In view of accidents quoted in technical literature on the failure of concrete sewage tanks, is there a plan to check routinely the strength of the concrete tanks?

No such methods are practiced now although a program of systematically checking the tanks appears to be desirable.

What precautions have been taken for meeting an emergency caused by failure of the tanks?

The 3,000,000 gallon capacity impoundment basin is available for transferring the liquids. The sludge on the bottom of the tanks is fairly hard and probably would not get out.

How will the contents of the tanks be known?

Exact inventories will be kept of the input.

What are the cost estimates for the system?

The two systems would cost 1.4 million dollars plus $300,000 for the Melton Valley waste collection systems.

Has the cost per gallon of the waste treatment been estimated?

This value is not computed yet; data available are not reliable to be used for this purpose.

How does the cost of storage and evaporation compare with each other?

Storage in the tanks would cost about 5 to 15 cents per gallon; however, there is not enough capacity available to store everything in tanks. It is planned to evaporate the liquid and to store perpetually the remainder. On the basis of a sinking fund, with 3% interest, it is estimated that the contribution of the waste treatment to the power cost will be 0.2 mils/kwhr.

Is the proposed system basically safe or will it increase the Laboratory's hazards problem?

The system is basically safe; two tanks will be used keeping one always in a standby condition for safety reasons. If one of them is completely filled a new tank will be built.

Is a detailed hazards analysis of the proposed system available?

This analysis is not ready yet although a similar one has been made for the Power Reactor Fuel Reprocessing Plant.

What is the reason for the variation of activity in the Clinch River?

These variations are due to fluctuations caused by the flow of water at Norris Dam. Usually the dam is shut off for two days each weekend to regulate the power of output. If the dam is more uniformly controlled, the peaks can probably be eliminated.

By what means will the 1.5 curies per month activity in the process waste be reduced?

One-half of the activity is in solid form and it will be attempted to remove half of the solids by settling; if this fails coagulants will be added. Great improvement is expected from the monitoring system which will be placed in operation soon. At present it is not known where this activity comes from, it is possible that it has been contributed by decontamination operations. A better policing system will be greatly helpful in reducing the activity.

Recommendations:

Although the Committee is not ready to present its final recommendations, it appears highly desirable to request a detailed hazards evaluation of the concrete tanks used for storing the waste effluents.

Submitted by Francois Kertesz
Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

September 6, 1961

FK:bMcH

Distribution:
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
J. O. Blomeke
F. N. Browder
K. B. Brown
F. R. Bruce
G. C. Cain
T. F. Connolly
J. A. Cox
F. E. Harrington
J. C. Hart (4)
T. W. Hungerford
W. H. Jordan
F. Kertesz
E. Lamb
M. L. Nelson
D. Phillips
H. O. Weeren
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: July 24, 1961 **Code Number:**

Present:

Members	Experimenters or Operators
W. H. Jordan, Chairman	T. A. Arehart
W. A. Arnold	F. N. Browder
K. B. Brown	K. E. Cowser
F. Kertesz	E. J. Witkowski
E. Lamb	
M. L. Nelson	

The Proposed Melton Valley Waste Collection Systems

Browder presented the proposals for collecting low-level and intermediate-level wastes from five installations in Melton Valley: HFIR, TRU, MSRE, the U-233 facility and the HRT site. The Fast Burst Reactor will probably not be added to this list because of its distance from the others. The proposed waste collection systems for Melton Valley are described briefly in the minutes of the July 10 meeting and in detail in ORNL-CF-61-5-24 and its Supplement No. 1.

The "low-level" waste in Melton Valley corresponds to the stream designated as "process" waste in Bethel Valley. It should normally contain very little radioactivity but there is reasonable probability for it to become contaminated either by accident or from misuse. In order to meet the Laboratory goal of less than 10^{-7} microcuries/ml concentration (the maximum permissible concentration in water for the neighborhood of an atomic energy plant) of mixed fission products in the creek at White Oak Dam, the low-level waste from Melton Valley installations must be monitored and a means provided for diverting contaminated waste away from the normal discharge to Melton Branch, which flows into White Oak Creek in Melton Valley. Therefore, all low-level waste from HFIR and its satellites, the TRU and U-233 Facilities, will pass through continuous samplers and radiation monitors and then through ponds before being discharged to the creek.

The pond for each facility will normally operate half-filled with water in order to settle out particulates from the waste. There is a divergence of opinion as to the necessity for this function of the ponds, as surveys of process waste indicate that particulates normally comprise only 0.2 to 2.0% of this waste. The TRU Facility, however, will handle alpha activity levels and isotopes not previously encountered at the Laboratory. Special precautions will be taken to prevent the escape of this activity, but the ponds will afford a further means of preventing such materials from reaching the creek. The ponds are designed to provide at least 12 hours hold-up for waste flowing through them. In order to avoid excess contamination of these "working ponds" and subsequent difficulty with over-tolerance effluent from them because of "bleeding" of the contamination by pond sediments into otherwise clean waste, the monitor arrangement will upon the detection of radioactivity shut off waste flow upstream of each pond, diverting the contaminated waste to HFIR Pond No. 2. Simultaneously, the exit valve from the pond will be automatically closed in order to hold the pond level constant. The valves will not be reset to the normal positions until chemical analysis indicate that it is safe to do so. Contaminated waste will be pumped from Pond No. 2 to the Bethel Valley lime-soda process waste treatment plant.

Although the Melton Valley low-level waste system is supposed to be nonradioactive, there are several potential sources of contamination including:

HFIR experimenters' cooling loop drainage;
HFIR coolant loop demineralizers;
HFIR cooling system heat exchangers, filters, and vessels;
HFIR decontamination pad drains;
HFIR reactor building drains;
HFIR cooling tower basin drain and blowdown;
HFIR filter pit cell drains;
TRU facility laboratory condensers and sinks;
TRU Facility coolant recirculating system blowdown;
TRU Facility floor drains;
U-233 Facility coolant system;
U-233 Facility floor drains.

It is intended to operate the Melton Valley research facilities with utmost care to avoid contamination of the low-level waste system and to avoid contamination in general, but from experience with the Bethel Valley process waste system some unintended contamination can be expected. Rough estimates have been made of the quantities of contaminated waste that the process waste treatment plant may be required to handle. These estimates from the five sites total about 40,000 gallons per day for the normal expectation and about 200,000 gallons as the maximum at any one time. These figures are well within the capacity of the existing lime-soda treatment plant, but they may prove to be quite conservative. Operating experience with the system will be required before any realistic figures are available.

The collection system for intermediate-level waste in Melton Valley was very briefly described. The significant point in this system is that each research facility will be provided with a collection tank, transfer pumps, and an individual 3-in. diameter transfer pipe from its tank to a central collecting station proposed to be located near the main Melton Valley road and between the HRT and MSRE sites. The provision of individual transfer lines will avoid interconnection and valving of waste pipes between sites and should avoid the overflowing of one facility's waste tank by a transfer from another's tank. The 3-in. pipes are proposed in order to allow rapid transfer of waste during periods of decontamination or in emergencies that might generate larger than normal quantities of this waste. The two 15,000 gallon tanks at the central collection station should provide sufficient surge capacity to allow the proposed 2-in. diameter pipe from the station to Bethel Valley to handle all anticipated volumes of this waste.

By far the largest volumes of waste in Melton Valley, as in Bethel Valley, will not have any chance to become radioactive and will therefore be discharged through sanitary sewers or storm sewers to the creek. Of the approximately 5,000,000 gallons per day of liquid waste currently discharged from Bethel Valley facilities, only about 400,000 gallons per day are directed to the process waste system. No continuous monitoring or sampling system is planned for the sanitary and storm sewers in Melton Valley, but the creek (Melton Branch) is already provided with continuous sampling stations. Periodic surveys of the "cold" sewer systems will be made, and these sewers will be sampled whenever the creek monitors indicate activity that cannot be traced to low-level waste sources.

Hazards Discussed and Safeguards Suggested

What cooling system is used?

> A single cooling tower is provided for HFIR, TRU, and the U-233 Facility secondary coolants; however, each user will have his own primary cooling system, being thus provided with a primary and a secondary system without any overlap of the primary water systems.

Can the waste stream follow an alternate path in case of emergency?

> The blowdown from the cooling tower will normally be discharged directly into the creek, but it can be automatically diverted to HFIR Pond No. 1 by its monitor. The chances for contamination are rather small as two events must occur simultaneously, e.g., a leak in the reactor and a break in the cooling system piping. The tower blowdown stream will not normally go through a pond unless the monitoring system indicates activity in the water.

What general steps are taken if activity is found in the other effluents?

> If the low-level waste stream from HFIR, TRU, or the U-233 Facility (each of which is normally sent through its own pond) shows activity, it can be diverted into Pond No. 2, and ultimately pumped back to the Bethel Valley system.

What can be done with the material if it is too contaminated to be treated at the soda-lime plant in Bethel Valley?

> In that case the effluent is to be sent to the 3,000,000 gallon emergency impoundment basin.

What type of accident could necessitate such a step?

> A fuel element meltdown in the HFIR or a major catastrophe that would set off sprinkler systems in the other facilities could result in serious contamination of large volumes of low-level waste.

What is the probability that events of such seriousness will occur?

Every step will be taken to prevent accidents; these facilities have been very carefully designed, so the probability should be quite low.

Is the HRT included in the system?

For geographic reasons the central low-level waste pond (HFIR Pond No. 2) will not service the HRT or any new facility that might be built south of it. The HRT site can easily be connected to the central collection station for intermediate-level waste.

What is the main purpose of the low-level waste ponds?

The primary purpose of the ponds is to serve as hold-up tanks to delay waste release. At the first sign of activity the monitoring instruments will send signals shutting and opening valves and directing the waste away from the affected working pond and to the central pond, which is expected to become contaminated occasionally. Sedimentation of particulate matter is only a secondary purpose of these ponds.

What is the sensitivity of the continuous monitors?

The currently available instruments cannot detect less than 50 times the environmental MPC value.

What kinds of particulate matters are considered?

This can only be surmised at the present time, as the nature of particulate activity is not known. From past experience it is expected that in addition to particulates, a large amount of the activity will be present in solution.

Where is the outlet of Pond No. 2?

This pond has no exit line to the creek; the liquid must be pumped back to the Bethel Valley system. Normally, some liquid will stay in the pond to shield the contaminated bottom. As mentioned before, its chief purpose is to serve as a collector for contaminated liquids.

How much activity is anticipated?

Normally, there should be no activity in this pond; however, about 1.5 curie/month has been detected in Melton Branch during the first half of 1961, presumably from the HRT.

Will the presence of activity cause any problem near and in the ponds?

No, the background level will not be greatly influenced. The activity itself will not cause any difficulty; on the other hand, raising or lowering the level of the ponds presents a more serious problem. Keeping the pond level at the same value will not cause any difficulty; the water will shield the activity.

What is the alternative of sending the activity to the pond?

Without the ponds, either all contaminated waste would be discharged to the creek or very large amounts of water must be treated to remove activity; in order to solve this problem satisfactorily, an arbitrary activity level was chosen in order to reduce the amount of water to be treated. Whenever this activity level is exceeded, the waste is diverted to the treatment plant; otherwise, it is sent to the pond. It is not definitely shown that this value is correctly chosen.

At what point is this level set at present?

On the basis of F. Gillespie's data, this value is set at 67 counts/min corresponding to about 100 times the environmental MPC value. The continuous monitor is not reliable below this value, but laboratory analysis is, of course.

Have any special provisions been made to handle the liquid in the emergency impoundment basin if its volume is greatly enlarged by rain and ground water leakage?

The impoundment basin might overflow as a result of the large rainfall prevailing in the area and a low seepage rate. The seepage rate is unpredictable but is expected to be rather low. A diversion ditch has been built around the pond to catch the run-off of rain from the area around the basin. The pond definitely will not be used as a seepage pit.

Under what condition will the emergency impoundment basin be used?

This basin is to be used as a last-ditch defense in case of true emergencies such as a fuel element meltdown; it should not be used for routine operations.

How will the so-called "semi-emergency" situations be handled?

The Bethel Valley system can take care of such a situation; possibly, the activity level could be slightly increased in White Oak Creek upstream from the dam.

Is there an emergency impoundment basin in the Bethel Valley system?

The same 3,000,000 gallon basin will serve both Melton Valley and Bethel Valley. This basin is now under construction. Its dam is made of clay which will become more leak-tight with time. It probably should be pumped full in order to test it.

Is it possible to monitor the normally non-contaminated ("cold") streams at a single location instead of checking a number of discharge points?

Considerations due to the topography of the area prevent this; a number of ditches carry the water to the creek and it would be difficult to bring them together into a single point prior to discharge into the creek.

According to the present plans, the 6-in. cast iron line for low-level waste and the 2-in. line for intermediate-level waste will be placed in the same ditch; could cross-leakage cause difficulty during maintenance operations?

Admittedly, there will be repair problems but they are not considered too difficult. At one time a pipe-in-pipe system was considered but this was discarded because of the maintenance problems it presented.

What is the attitude of the contributors to the present system?

Very good cooperation has been received in Bethel Valley from the contributors to the waste system; certain areas such as the storage canals must be further improved but in general the situation is satisfactory.

Is it the intention of the designers not to discharge any alpha-contaminated waste activity above the MPC_w level, not even to the treatment plant?

This is correct. Present plans are to consider such waste as intermediate-level waste to be evaporated. No credit is taken for decontamination of alpha activity through the lime-soda plant. Admittedly, this is somewhat restrictive because the treatment in the plant will definitely reduce the activity of the stream.

When will the Transuranium Facility be in full operation?

The TRU will obtain the required amount of feed material only after the HFIR has produced enough irradiated material.

What additional operating capacity for waste streams is available in the present Bethel Valley system?

There is no extra capacity available; in case of an accident all processing of routine waste will be stopped, discharging the stream directly into the creek to make place for the treatment of the contaminated waste which will be pumped over from Melton Valley. The capacity of the lime-soda plant is actually the weak link in the system. At present there is a small safety margin in view of the fact that the plant has a capacity of 500,000 gallons per day and only 400,000 gallons per day are discharged; however, it should be pointed out that all the plants connected to this system are not in full operation at present.

What improvements could be made in the present system?

When Building 3019 starts operating again it should be provided with a recirculating system for condenser cooling water. The cost of these systems is quite high; the one for Building 3019 is estimated at about $100,000. Any future expansion of the Laboratory should be carefully studied and proper recirculating systems should be included in the design. An ion-exchange waste treatment plant for treating 750,000 gallons per day with a strontium D.F. of 1000 and an overall D.F. of 100 could be installed for a total cost of $514,000. This plant has not been requested in the current proposals.

What is the estimated cost of the proposals?

1.7 million dollars have been appropriated for two high-level waste storage tanks, a 600 gallon/hr evaporator for intermediate-level waste and the Melton Valley collection systems.

Will the TRU Facility have a recirculation system?

Yes, it will use the HFIR tower for its secondary coolant.

What will happen to the material remaining after evaporating the intermediate-level waste?

It will be stored in the existing concrete waste tanks or the proposed stainless steel high-level tanks. Experiments are in progress on disposal by hydrofracture and pot calcining methods.

What is the present status of the Laboratory's day-by-day waste disposal operations?

On the basis of past and current results, it can be stated that the Waste Disposal Group does an excellent job with somewhat inadequate facilities.

What is the main deficiency of the present system?

Either a new ion-exchange treatment plant to replace the lime-soda plant or a secondary plant is needed downstream from the existing lime-soda plant because that facility cannot remove all the activity. Studies financed from operational funds have been made on the use of the settling basin for improving particulate activity removal; the basin was originally built for such a purpose but was never actually used. The currently available decontamination factor for the lime-soda plant (normally about 8 and potentially 20) is not sufficient.

In which way will the new monitoring system help the waste disposal effort?

The manhole monitors will help to pinpoint the chief contributors and make it possible to shut down the offending plants.

What is the status of the Graphite Reactor demineralizer canal?

The design is all finished but no funds have been appropriated. Placing the Metal Recovery canal in standby status should improve the situation.

What is the reason for choosing two different pipe sizes for the transfer line which returns the waste from the TRU Facility to Bethel Valley (3-in. diameter from the TRU tank to the central station and 2-in. from there to Bethel Valley)?

The amount of the high-level and intermediate-level waste at the TRU Facility will be relatively small, amounting to only a few hundred gallons; instead of accumulating the material over a long period, it will be transferred as soon as the 1000 gallon collection tank is filled.

The 3-in. pipe will allow rapid transfer to the central station but would require over 2000 gallons to fill it over the 6000 feet from the central station to Bethel Valley. Therefore, a 2-in. diameter line was chosen for the 6000 ft run. The pipes at the collection site are chosen by the individuals in charge of these facilities, who pay for the pipeline from their facility to the central collection station and for their tanks.

Is the integrity of the system definitely established?

Pressure tests are performed between pumping operations. This has proved adequate for the similar flanged-joint lines already in use between Bethel Valley and the waste pits.

How is the material sent to the central collection point?

A separate line is used for each facility instead of a single branching line which requires frequent checking of the valve settings. Back-flow prevention has been provided for. The five separate pipe lines present a higher initial expense but they make the overall system more flexible.

Are the low-level and intermediate-level systems connected?

No, but a connection can be easily made by means of a jumper.

What is being done to eliminate the danger presented by a water line in contact with the hot waste line?

This danger is much exaggerated; in-leakage is highly improbable in view of the fact that the water line is under 90 psi pressure.

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: July 24, 1961
Subject: The Proposed Melton Valley Waste Collection Systems

What kind of monitors will be used?

The monitors will be of the "fail safe" type.

Recommendations:

The proposed system is approved as presented.

Submitted by Francois Kertesz

Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

September 25, 1961

FK:bMcH

Distribution:
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
F. N. Browder
K. B. Brown
F. R. Bruce
G. C. Cain
T. F. Connolly
K. E. Cowser
J. A. Cox
J. C. Hart (4)
T. W. Hungerford
W. H. Jordan
F. Kertesz
E. Lamb
M. L. Nelson
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

Committee ... Effluents

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: August 7, 1961 **Code Number:**

Present:

Members	Experimenters or Operators
W. H. Jordan, Chairman	K. E. Cowser
W. A. Arnold	E. J. Witkowski
K. B. Brown	
F. Kertesz	
E. Lamb	
D. Phillips (Substitute)	

Operational Experience of Radioactive Waste Disposal at ORNL

Witkowski reviewed the current operation of the waste disposal system:

Process Waste System -- Very good progress has been made on this field during the last year. The discharges were the lowest in the history of the Laboratory with an average of 1.5 curies/month during the last quarter. This value compares very favorably with the discharges of 20 curies/month years ago and of 10 curies/month more recently. This tremendous improvement is due in part to the suspension of operation of several contributors such as the hot pilot plants, the Metal Recovery Plant and especially its storage canal. On the other hand, credit must be given for the improved situation to the increased safety consciousness of all the users of the waste disposal system. Instead of simply discharging their waste effluents as was the general practice before, now they often ask the opinion of the Waste Disposal and Decontamination Group members whether the proposed action is admissible.

Since last December the volume of water discharged has been reduced to such an extent that it is possible to treat all the waste instead of only part of it. Further improvement may be expected if the recirculation of the cooling water, now practiced only by the Fission Products Development Laboratory will be used also by the other contributors.

Operation of the process waste monitors, the installation of which is now nearly completed, should also result in considerable reduction in the activity level of the day-to-day discharges. Once this new system is in full operation it will be possible to pinpoint the origin of the last 1.5 curies/month which could not be eliminated up to now. It is surmised that about one-half of this activity comes from the Graphite Reactor canal; a large part of the remainder probably originates at the decontamination building but in the absence of a good monitoring system the exact values cannot be ascertained.

Hazards Discussed and Safeguards Suggested

Will the activity of the water be removed during the recirculation?

No decontamination treatment is planned because the recirculated cooling water is expected to be inactive.

In what manner will monitors be helpful for improving the situation?

The monitors will help to pinpoint the sources giving the exact time and location of the release of activity. In that manner contributors who often do not know that a leakage occurred can be warned and the necessary remedial steps can be taken.

What other improvements are anticipated?

The new decontamination building, particularly the new hot tank which will be used for the effluents originating from that building, is expected to be very helpful. At present the liquids from decontamination operations cannot be stored or checked for activity; they are sent directly to the process waste system.

Can the amount of liquids used for decontamination be reduced?

At present, in view of the inadequate facilities, a large amount of water is wasted as the equipment to be decontaminated is often simply hosed down. In the new building the water will probably be recirculated thus reducing the volume.

When will this facility be available?

It will take several years before the new building will be in operation; the preliminary plans of the architect-engineer were received only recently.

What steps are taken now to remove solids from the process waste treatment plant effluent?

It is attempted to remove the solids by sending the process waste treatment plant effluents through the old settling basin; however, this operation was not very successful because the basin was plugged up and the operations had to be suspended. Plans are being made to remove the solids by putting the basin back into operation. Coagulant "A" recommended by K. Cowser might be tried.

Is the 1.5 curie/month discharge acceptable in view of the more stringent requirements of the Laboratory?

This value is too high by about a factor of 10 on the basis of the 10^{-7} microcuries/ml long range goal set by the office of Radiation Safety and Control; the activity of the currently released stream in the creek reaches a value of about 10^{-6} microcuries/ml.

What is the most important component in the activity discharged?

From biological viewpoint strontium-90 is the most important constituent of the process waste stream; cesium-137 is of less importance and the other isotopes are considered to be trivial.

Where does the strontium originate?

The process waste system and HRT are the main contributors of the strontium.

What is the present situation with respect to high level accidental releases?

The 3,000,000 gallon emergency pond and a 6-in. pipeline are under construction and, weather permitting, will be ready in about 6 weeks. It should be emphasized that this system will not be of any help for the day-to-day discharges but it will be extremely useful in case of an unexpected large release of activity.

What progress has been made with the hot waste system?

The activity discharged to the creek through the pits by means of the hot waste system is still high. During the month of June about 600 curies were discharged in the creek; practically all of this activity consisted of ruthenium. The discharges during March, April and May were lower but during February the activity was somewhat higher.

What is the reason for the high level of activity?

The excessively high rainfall caused difficulties. During this time of the year Pit No. 4, which is the worst offender, is usually dry; at present this pit is filled with water. In addition, the decontamination operations in Building 3019 contributed considerably to the hot waste system. It has been noticed in the past that shut-down facilities often contribute more during the decontamination period than full-scale operations.

The situation was so serious that the open pits and trenches could not handle all the liquid because it did not seep through fast enough and tanks had to be used for storage.

What immediate steps have been taken to remedy this situation?

Attempts were made to recirculate some of the seepage although admittedly it is not clear whether this is helpful.

Are other improvements planned in the hot waste system?

Pit No. 6 which will replace the open pits is already completed. Copper sulfate solution will be added as recommended; if the flow follows the previously established pattern this material will start to seep out in a few weeks. Construction of the roads and of the auxiliary facilities will be completed soon. In the meantime the hot waste will be retained in the tank farm instead of the open pits. On the basis of available data it is estimated that the new system will be able to take care of about 10,000 gallons/day which is more than adequate.

Will the seepage from the old pits be sent to the trenches?

This is not possible because of the large volume and the great distance between the two facilities.

How is the filling operation of the old pits proceeding?

The old pits cannot be filled as fast as is desirable because the liquid does not seep out fast enough.

Can the ruthenium be satisfactorily retained in the trenches?

Copper sulfate or reducing agents such as sodium sulfite were added to the waste to achieve this. The results were disappointing because it is difficult to obtain good mixing.

What is the schedule of the long range improvements of the hot waste system?

The evaporator system should be ready for operation in 1963; at that time the trenches will be completely abandoned.

How will the sludge from the waste treatment plant be handled?

This material will be sent to the burial ground for disposal.

What steps will be taken after the completion of the Pit 4 filling operations?

There was some concern about possible pH changes resulting in the release of bound radioactive material, but this is improbable. To be absolutely safe, asphalt will probably be sprayed over the surface of the fill although a simple dirt mount probably will be sufficient.

What is the current background radiation situation?

It reaches as high as 500 mr/hr at present but it is expected that it will be reduced by a factor of 100.

By what mechanism will the radiation be decreased?

As the dirt is filled in the liquid level will be raised; rain water will dilute the system decreasing its activity.

Could dry dirt be used to absorb the liquid?

The cost for digging fresh dirt is fairly expensive, it might reach $10,000 per pit. It appears to be more economical to perform the operation more slowly.

How is the hot waste disposed of at present?

About one-half (3,500 gallons) is sent to the pits and the same amount is directed to the trenches.

How does this amount compare with the rainfall in the area?

The amount of the rain water is of the same order of magnitude.

What is the present status of the creek monitoring?

Proportional samplers and flow measuring devices have been installed on the two main seep streams at the Melton Branch and at White Oak Creek. The system has been in actual operation for more than two months.

Have any conclusions been drawn from the data obtained?

It was found that the discharge from the 7500 area is the same as that of the whole Laboratory. In order to make progress, the HRT pond discharge must be discontinued.

What is the radiochemical balance of the system?

The strontium balance is quite acceptable; the values obtained in different locations agree well with each other. On the other hand, the ruthenium balance is unsatisfactory. About one-half of the ruthenium released to the creek apparently never reaches the dam.

What is the present status of creek monitoring?

The situation is not quite satisfactory. It should be remembered that these observations are based on only two months of operational experience.

How could the situation be improved?

Several obvious holes in the system such as the storm sewers which are not monitored at present must be plugged. In addition, it is proposed to split the creek into sections and monitor each section separately.

What advantage could be derived from such a system?

As an example, a discharge of several curies from a leaky line occurring at the isotope area last February could be mentioned. The monitor at the bridge indicated an increase of the activity level during the jetting operation. A group of monitors suitably placed in the creek would help detect this situation at an earlier time.

Is a continuously recording monitor available at the present time?

No, although great interest has been expressed in such an apparatus.

What types of research samples are being taken at the present time?

Composite samples of the surface water are taken at several points including a location near the construction area below Building 4500; stream water samples below Building 1000; samples from the White Oak Creek upstream from the waste effluents (for determining background radiation). A station is planned at Fifth Street below the cooling tower.

Were there instances when the availability of additional monitors would have prevented accidents or near-accidents?

In one instance a leak occurred in the jet line from the pit to the hot waste tank farm and at the same time the discharge from the pit was leaking into the process waste system. The potentially dangerous situation resulting from this double leak could have been better taken care of if sufficient monitors had been available. Too much reliance is placed on a single monitor at the 7500 area bridge.

Are there other weak points in the system?

The Laboratory's sampling and analytical facilities can become overloaded in case of an accident. There is a great need for a portable instrument that would allow rapid local determination of the activity.

What use is made of the information obtained?

The data from the proportional samplers and chemical analysis are published in the monthly report; the monitoring data serve to indicate operational difficulties.

From what sources does the strontium now detected in the system originate?

In average about 0.7 curies/month comes from the process waste system and about the same amount from all the other sources. During the month of June when the strontium activity was less than 1 curie for the whole Laboratory it probably originated either from the process waste or from Melton Branch.

Could some strontium be released from the sediments of the White Oak Lake bed?

Recent surveys made in 1960 indicate a combined loading of 15 curies of strontium-90; since 1956, 5 to 10 curies/year have been apparently released to the Clinch River.

Does any material come through the sewage treatment plant?

There was an accidental discharge some time ago but for years no radioactive discharges were made through this system.

There is some disagreement on this subject among the experts; some hold the opinion that a relatively significant amount, as much as 0.1 curie per month, may originate at that location.

Is there any overlap between the points of origin of the data reported in the monthly report by the various groups?

The Operations Division reports the material that goes into the creek; the Health Physics Division is assigned the duty of reporting the discharge at the dam. There is cooperation between the individuals in the various groups charged with keeping track of the activity release to make sure there is no unexplained discrepancy between the data.

Did the composition of the activity discharged change during the recent months?

The strontium concentration went down while the ruthenium increased. The data refer to contributions from all sources: pits, Melton Branch, and White Oak Branch before the effluents are combined.

Although ruthenium is not too hazardous biologically, can it cause other difficulties?

If the water is used for special purposes where high purity is required, such as the manufacture of photographic paper, the presence of radioactive ruthenium is troublesome.

Are there special problems which the Operations Division would care to bring to the attention of this Committee?

In general very good cooperation is received by the Operations Division from all persons involved. The chief problem consists in the difficulty of obtaining the needed instruments, particularly creek monitors.

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: August 7, 1961
Subject: Operational Experience of Radioactive Waste Disposal at ORNL

The difficulty of operating the waste disposal system is due to the fact that accidents cannot be predicted. A large discharge of activity usually comes as a surprise rather than a planned operation. Among other possible sources, the activity dumped unexpectedly in the storm sewer presents a potential hazard. The laboratory sinks are connected to the sanitary sewer or to the process waste; known hot operations are connected to the hot waste system. Problems may arise from a crossover between these separate systems, f.i. between the hot waste and the sanitary or the storm sewer. This is not impossible because the storm sewer pipes are not always very solidly installed. The storm sewers may be contaminated also by material settling on the grass and washed down by rain as it happened one and a half years ago. Some hazard is created by the fact that certain facilities such as the laundry discharge directly into the creek.

What is the general status of the liquid waste disposal efforts of the Laboratory?

In general the situation is much better than it used to be. Some of the chief offenders are eliminated: the Graphite Reactor canal is being improved; the Metal Recovery canal is shut down and will not be used again; the Decontamination Building represents a long range project which cannot be speeded up but when finished will further improve the situation. New facilities, such as operations in the new Building 4507 are carefully planned and should not present any problems. Further improvements can be made, in particular by expanding the monitoring system; at the present time a very large unit such as Building 4500 complex has only one monitor.

<u>Recommendations</u>:

The Committee supports the request of Operations Division to install additional monitors.

Submitted by François Kertesz

Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

September 11, 1961

FK:bMcH

TX-2705 (1-61)

LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents
Meeting Date: August 7, 1961
Subject: Operational Experiences of Radioactive Waste Disposal at ORNL

Distribution:
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
K. B. Brown
F. R. Bruce
G. C. Cain
T. F. Connolly
K. E. Cowser
J. A. Cox
J. C. Hart (4)
T. W. Hungerford
W. H. Jordan
F. Kertesz
E. Lamb
M. L. Nelson
D. Phillips
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

a3min
JAS
Subj

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: August 21, 1961 **Code Number:**

Present:

Members	Experimenters or Operators
W. H. Jordan, Chairman	C. J. Borkowski
W. A. Arnold	T. J. Burnett
N. C. Bradley (Substitute)	J. A. Cox
K. B. Brown	B. R. Fish
F. Kertesz	H. H. Holladay
M. L. Nelson	D. J. Knowles
	J. F. Manneschmidt
	E. J. Witkowski

Gaseous Waste Disposal at ORNL

Manneschmidt reported on the present practices and available facilities at the Laboratory for disposing of gaseous radioactive waste.

The Laboratory currently generates and discharges to the atmosphere approximately 300,000 cfm of radioactive gaseous waste through three stacks.

The discharge from the 3020 stack consists of cell ventilation air (or about 40,000 cfm) from the Building 3019 cells, analytical and operating areas. The pilot plant discharge is filtered before release to the stack using absolute filters with an efficiency rating of greater than 99.9% for 0.3 μ particles. The activity discharged consists mostly of I-131 with occasional traces of thoron daughters. Emission of activity from this area has decreased sharply in recent months.

The 3018 stack releases cooling air from the Graphite Reactor at the rate of approximately 120,000 cfm through roughing and polishing filters before release. The activity is due essentially to I-131. In addition to other rare gases it is estimated that 400 curies per day of A-41 alone are released.

The 3039 stack takes care of the balance of the gaseous waste generated by the Laboratory amounting to approximately 138,000 cfm. The predominant activity at this stack is I-131 from the Isotopes Processing area although lately at least seven other nuclides have been detected.

Two distinct gas handling systems are provided at the 3039 stack: cell ventilation air, a large-volume, low activity stream from laboratory hoods or process cells with operating or storage equipment; and vessel off-gas, a system with a much smaller volume containing higher activity amounting to only about 3% of the stack total, which comes directly from process vessels and other tank ventings and is considerably more active than cell ventilation air. No cleanup facilities are provided for the cell ventilation discharge but off-gas air is now scrubbed and filtered; previously a Cottrell precipitater and filter were used. The new facility, with a capacity of 2500 cfm consists of a caustic scrubber to remove I_2 and other reactive gases, filters to remove particulates, and a section of silver plated copper mesh to remove last traces of I_2. The filter section consists of a fiber glass prefilter followed by a pleated Cambridge absolute filter and is rated to retain more than 99% of the 0.1 μ particles. The efficiency of the unit is not definitely established yet. Sampling of the off-gas stream because of the prevailing low pressures involved has caused difficulties.

In addition to the central off-gas cleanup facility, many of the individual processing groups throughout the laboratory maintain their own cell ventilation or off-gas cleanup systems.

The Operations Division monitors all of the gas streams: for inventory purposes, a continuous sample of stack gas is withdrawn and the activity collected by passing through a small membrane filter and a charcoal cartridge. These collections are made daily at each of the stacks and the filters and cartridges are gamma-analyzed to determine the nuclides present and the amounts of these nuclides are measured. Knowing stack throughputs and sampling rates, a daily activity discharge figure can then be calculated. These figures are reported weekly and a bar chart is kept on a monthly basis (see Appendix).

This collection technique is limited by the deficiencies of the sample withdrawal system which canal high losses of large particles and adsorbable gases due to plating-out, centrifugal effects, turbulence, etc.

Monitoring systems have been installed at the 3018 and 3039 stacks; they do not measure or identify activity but only detect its presence. A charcoal trap containing an ion chamber and a non-moving tape monitor are attached to a sample line located at the 50 ft level but operating on the ground at the 3039 stack, while a moving tape monitor is located at the 50 ft level on a relatively short probe.

All three instruments are connected to suitable alarm devices. The equipment at the 3018 stack is similar to this. An ion chamber detector monitoring the discharge from the off-gas system complements the stack monitors. In the event of an activity release at the 3039 stack indicated by this system filter samples are taken at each of the five main cell ventilation ducts and from the off-gas discharge leading to the stack. These filters may be quickly analyzed and will reveal the origin of the activity being released. Although the filter samplers are kept in operation at all times and are changed and beta-counted daily they are analyzed for specific nuclides only in the event of a suspected abnormal release.

Plans are being prepared for a much more extensive gaseous waste monitoring system with maximum sensitivity for all types of activity (including large particles), providing for swift isolation of any unwarranted activity release. The design of a stack monitoring system was the first step in the overall plan. About a year ago Tracerlab, Inc. started a study of the gaseous waste discharged from the 3039 stack for the purpose of designing a system which would provide the maximum in monitoring. At that time an operational monitor which would identify and continuously integrate the curie discharge of a variety of nuclides was being considered. Such a system was found to be too complex and expensive and the Tracerlab proposal was abandoned.

Later a committee of three was created to continue the investigation of the stack monitoring problem attempting first to design a satisfactory sample withdrawal system. A three-probe array was installed in the stack for the purpose of comparing the activity levels in the three sample streams withdrawn. However, because of operational difficulties only one of the monitors is operating satisfactorily at present. After installation of the withdrawal system a variety of monitors may then be added including a modified charcoal trap, a scrubber for iodine removal and detection, gross gamma monitors, etc. eventually extending the system to the 3018 and 3020 stacks.

A work order has been written for the purchase and installation of the moving tape monitors at an estimated cost of $12,000; however, the lack of priority has delayed this project.

Fourteen critical locations throughout the area were chosen for installing upstream samplers with only the filter-charcoal cartridge assembly for monitoring the various cell ventilation streams at their origin. Cost estimates ranged from $1,000 to $1,500 per station; work orders have since been written for the equipment to be installed at five of the locations.

Suitable flow measuring equipment located in the various tributaries of the off-gas system would not only assist in keeping a more accurate activity discharge inventory but would be even more valuable in monitoring the distribution of off-gas capacity throughout the Laboratory. Such a flow measuring system has been designed at an estimated cost of $37,000. A request for $14,000 for the necessary equipment was made two years ago but was not approved. Recording anemometers have already been installed in the four major cell ventilation ducts.

Plans have been prepared to centralize the Laboratory's waste monitoring instrumentation including all the stack and duct monitoring devices. Readouts from all instruments will be telemetered to the Waste Monitoring Control Center, Building 3105, where they will be recorded and checked routinely. The building has been completed and installation of the instruments is expected to start soon.

In the opinion of the Operations Division personnel, the Laboratory has made good progress on the field of gaseous waste disposal and monitoring. There is an increased awareness of the existence of gaseous waste hazards. Although many improvements of existing facilities are in progress, the overall effort could be accelerated by better coordination and establishment of suitable priorities. The design of gaseous waste monitoring equipment is of sufficient importance that it should not be relegated to a committee for completion nor should it take the status of a part-time job for a scattered group of individuals.

Hazards Discussed and Safeguards Suggested

How does the situation this year compare with findings in previous years?

> Unfortunately no complete data are available for previous years although some scattered values were collected. It can be stated, however, that the situation is much improved. Some improvement might be due to the fact that several major radiochemical operations are shut down.

Is it planned to install a cleanup system at all the facilities?

> No, this is not needed for the small plants and facilities but it is planned to clean up the off-gases at all the major facilities.

What is the general philosophy with respect to new users?

> Each division, which has a facility under its jurisdiction tied to the waste disposal ducts, has the obligation to make sure that the off-gas is either filtered or that it will not contain activity.

Is the exhaust of any hot cells sent to the waste disposal system without previous filtering?

> There are several such cells in Building 3026 but no hot operations are planned in the near future.

Is this considered to be an unsafe situation?

> While it is true that many operations can be performed safely without filtering the off-gas it is not desirable to have connections to the main gaseous waste disposal duct without providing them with filters. While the experimenters are very conscientious and consult with Operations Division whenever they have a problem, it is always possible that an unexpected release will occur.

Is all the iodine activity removed from the released gas?

> This is the intention of the operators and experimenters but the data indicate that amounts reaching as much as 1 to 2 curies/week of I-131 are released to the atmosphere.

Committee: Waste Effluents
Meeting Date: August 21, 1961
Subject: Gaseous Waste Disposal at ORNL

How well does the present system operate?

It is estimated that about 60% of the activity is removed; the figure is much better for the removal of particulate activity.

Which facility contributes the largest amount of activity at the present time?

The I-131 plant which operates only once a month works with very high level material and accordingly contributes greatly to the activity present in the off-gases of the Laboratory. The situation was better in the past when the plant operated more often with low-activity material.

What is the efficiency of the iodine removal by the I-131 plant's scrubber?

Although the efficiency is at least 98%, a considerable amount of I-131 reaches the atmosphere in view of the large amounts processed.

What other hazards are presented by the gaseous waste removal operations?

"Organic gases and nitrate vapors may ignite charcoal traps or cause explosions in them. For this reason no charcoal traps are used in the system."

What is the reason for installing the monitoring system at the 50 ft level?

The samples taken there are needed for inventory purposes.

How often are the samples taken?

At present they are taken once a week; this is partially motivated by the fact that the surveyer has to climb a 50 ft ladder to reach the temporary scaffolding where the instrument is located.

What is the purpose of taking these samples?

The primary reason is to satisfy the legal requirement*. These inventory samples must be taken at suitable daily or weekly intervals and analyzed in order to have a clear picture about the total amounts released. As a general rule the weekly samples must be supplemented by additional data to calculate the decay of weekly samples.

The second purpose of the sampling is to establish what must be done to improve the overall handling of gaseous waste and determine which processes

---

* The legal requirements are not actually spelled out in detail but it is understood that the Laboratory will attempt to satisfy the specifications of the Federal Radiation Council.

need further study. A monitor is needed in order to determine which of the sources contributed to the activity.

What are the problems of choosing the right instruments?

The quality of information costs money. An instrument which indicates immediately that the activity went up will cost more than one that relies on a sample to be analyzed later; on the other hand, an immediately indicating instrument will allow the operators to take the necessary steps quickly while the release is in progress. The duration of the incident is of great importance in this respect. A short burst of activity (lasting only a few minutes) will be over before anything can be done about it but at least the information is available. Thus the value of the system and its cost depends greatly on the legal requirements which must be fulfilled and on the urgency of corrective measures to be taken in case of an emergency.

What is the present situation in view of the above-mentioned criteria?

Weekly samples might be satisfactory to fulfill the legal requirements. On the other hand, it should be emphasized that the Laboratory is committed to do as good a job as possible in determining the released waste inventory with the currently available facilities. For monitoring purposes the exact inventory does not have to be known only the fact that something did occur must be unequivocally established. In general the Laboratory does a creditable job in this respect although the alpha-monitoring is not as good as would be desirable.

Which stacks are provided with filters at the present time?

The Graphite Reactor stack has its own filter while the Pilot Plant stack filters the vessel off-gas system. No filter is provided at the 3039 stack itself; only the contributor filters its own stream.

In view of the double containment requirement for radioactive operations at the Laboratory, why are filters not provided at all the stacks?

This is a question of priorities and available funds; it is also planned to install filters at the isotopes stack and all the tributary ducts.

What is the currently valid maximum permissible concentration level for I-131 in the air?

Certain changes are proposed for the MPC of I-131 but they will not have an immediate effect on the release at the stack. The Federal Radiation Council is considering new values for the I-131 intake of controlling members of the population. The proposed level is 10 micro microcuries/ liter of milk. On the basis of Chamberlain's work in England this would correspond to 100 micro microcuries of I-131 per square meter of grass.

Does the Laboratory satisfy this requirement at the present time?

This is difficult to establish because the regulations are not quite clear. According to the AEC Manual, the release to the environment is averaged out on a yearly basis. In this respect the Laboratory's situation is acceptable but on several occasions the currently valid value was exceeded for short periods. The licensee requirement allows to average up to a period of one week. The regulations also specify that when the gases are released at a stack the measurements should be taken in the duct because there is no control after it leaves the stack.

What regulation does the Laboratory follow at the present time?

The Laboratory lived under a double standard of both licensee and contractor regulations. For a long time the licensee agreement did not apply to ORNL; however, a year and half ago ORO requested UCNC to indicate whether application of the licensee requirements would present problems at the Laboratory and at the production plants.

Assuming that the licensee requirements will be applied, is the Laboratory violating them?

Our present atmospheric contamination is about 10^{-5} microcuries/cc at the stack, the MPC value is 10^{-9} microcurie/cc on the ground. Strictly speaking the value might have been exceeded at the stack level but probably not at the ground level. More confusion arises from the fact that the new regulation refers not to a release rate but to an intake rate by infants.

The Federal Radiation Council provides for several classes of operation: Class 1 operation includes facilities as a result of the operation of which the controlling members of the population will be exposed to 1 to 10 micro microcuries/day of specified isotopes including radium and iodine. Class 2 operations go up to 100 micro microcuries/day. If the operator can show that his operations are within Class 1, only a minimum amount of monitoring is required. Class 2 is an intermediate level requiring more elaborate monitoring but if the operations reach the Class 3 level, beyond 100 micro microcuries/day, it must be shut down immediately. There are areas in the Laboratory where this value is exceeded.

What is management's attitude to this regulation?

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: August 21, 1961
Subject: Gaseous Waste Disposal at ORNL

Health Physics supervision reviewed the data and agreed with the conclusions. The Director of Radiation Safety and Control and other individuals involved in this field follow the latest regulations very closely.

The difficulty in the administration of this regulation arises from the determination of the average intake. It is not clear whether an isolated infant or an average of all the infants in the whole area must be considered. Another difficulty is caused by frequent revisions of the draft of the regulation and it is not known which version will be accepted (and whether it will be acceptable to ORNL).

What is the possibility of a "public relation incident" with respect to the gaseous waste disposal?

The I-131 situation presents a much more serious problem from the viewpoint of public relations than the small amount of occasional liquid waste release which manifested itself only as a nuisance in the fabrication of paper for photographic use in Chattanooga.

Are they attenuating circumstances in this respect?

The average dairy receives its milk from a large number of farms, only one of which might be in the affected area. However, as a counter argument it can be pointed out that an infant living on such a farm might receive only the milk from a cow which ate the contaminated grass.

It should be emphasized that the available data represent single measurements; the situation is much more satisfactory if they are averaged for a whole year as probably permitted by the new regulation.

The levels specified are so low that the only way they can be measured is by collecting thyroids of cows. An offer from the UT Experimental Farm has been received to study this question in collaboration with ORNL.

Recommendations:

In view of the complexity of the question another session will be devoted to the discussion of the stack monitoring problem. The following interim remarks can be made:

1. The situation appears to be quite marginal for I-131 if the proposed regulation of the Federal Regulation Council will indeed go into effect.

2. The data quoted of these regulations refer to intake by the controlling members of the population; it appears desirable to develop on this basis actual figures for stack release which can be used as a guide post by the Operations Division.

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: August 21, 1961
Subject: Gaseous Waste Disposal at ORNL

3. From a practical viewpoint it appears desirable to emphasize the fact that the main cleanup of the off-gases should take place at the source when they are more concentrated rather than at the stack where very large quantities (about 2500 cfm) are handled.

4. In order to round up the figure the Isotopes Division personnel will also be invited to present the methods they are taking at the I-131 plant for preventing area contamination.

Submitted by Francois Kertesz

Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

September 29, 1961
FK:bMcH

Distribution: T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
C. J. Borkowski
N. C. Bradley
K. B. Brown
F. R. Bruce
T. J. Burnett
G. C. Cain
T. F. Connolly
J. A. Cox
B. R. Fish
J. C. Hart (4)
H. H. Holladay
T. W. Hungerford
W. H. Jordan
F. Kertesz
D. J. Knowles
E. Lamb
J. F. Manneschmidt
M. L. Nelson
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

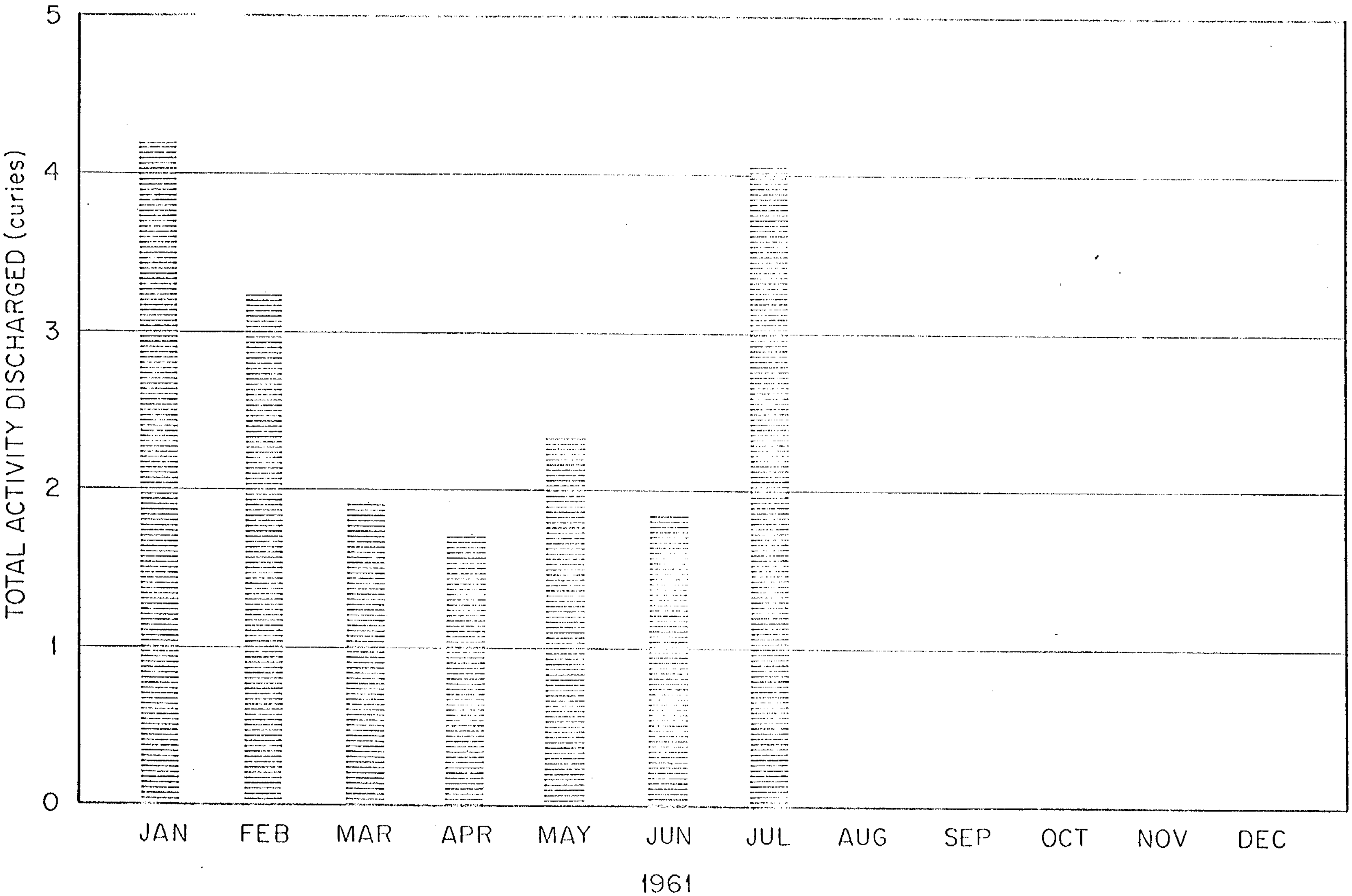


Fig.
Gaseous Activity Discharge to Environment

Committee
Wst. Eff.

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: September 5, 1961 **Code Number:**

Present:

Members	Experimenters or Operators
W. H. Jordan, Chairman	T. A. Arehart
K. B. Brown	C. J. Borkowski
E. Lamb	T. J. Burnett
F. Kertesz	A. M. Carlson
M. L. Nelson	B. R. Fish
D. Phillips (Substitute)	J. H. Gillette
	J. H. Holladay
	D. J. Knowles
	J. F. Manneschmidt
	R. A. Robinson
	E. J. Witkowski

Gaseous Waste Disposal at ORNL, Part II

B. Fish discussed the problem of the maximum permissible amount of I-131 released through the stacks. In addition, he reviewed the four primary sources of standards applicable for release of radioactive materials into the atmosphere which are as follows:

(1) The Waste Effluents Committee representing the Laboratory managements viewpoint;

(2) The UCNC four-plant committee responsible for preparing radiation standards and practices;

(3) The State of Tennessee which up to now has not prepared any standards but may do so in the future (the city of Oak Ridge should also be included as it has the authority to issue regulations);

(4) Pertinent chapters of the AEC Manual which are considered as the most important factor on this field.

At present the AEC has the overall responsibility for health protection; these duties are carried out by its headquarters group and by the various field operations branches. The non-AEC facilities are regulated by Title 10 of the Code of Federal Regulations; they are inspected regularly and held responsible for any contamination they might cause.

There is a basic difference between the AEC Manual chapters which apply to ORNL as an AEC installation and the Federal Regulations which control the non-AEC facilities. The manual refers only to the results of the waste disposal operations while the Code of Federal Regulations specifies the manner in which it must be carried out. AEC justifies this double standard by pointing out that the contractors have demonstrated their competence on the field of health protection; it is emphasized that in the end the same figures are used for both the contractors and the licensees.

At present, Chapter 0524 is being revised as the latest issue of the manual is dated February 1958. The proposed revision of the manual has been examined at the Laboratory and comments of the individual reviewers transmitted to ORO. The revision largely reflects the viewpoint of the Federal Radiation Council except for the lack of any reference to the Radioactivity Intake Guide suggested in the draft of Report No. 2 of FRC(1).

As a general philosophy the Commission accepted the value of 0.5 rem/year as the limiting dose to the gonads from all sources (0.17 rem/year in the proposed revision of Chapter 0524). In view of the fact that the total radiation exposure from all sources to the general population cannot be controlled by AEC, the manual chapter refers only to limiting radioactive effluents from AEC operations such that these (disregarding medical exposure, fallout, etc.) will not be expected to expose the population as a whole to more than an average of 0.5 rem/year or 1/10 of the occupational maximum permissible concentrations in air or water (0.17 rem/year or 1/30 of occupational MPC in the proposed revision). Because of the large controlled area and as a result of the average meteorological dilution available before gaseous effluents could reach uncontrolled areas, exposure to the general population has not been considered to be a controlling factor at ORNL. This conclusion has been substantiated during many years of environmental monitoring by the Health Physics Division. For this reason stack release criteria have been adopted guaranteeing that the maximum ground concentration within the Laboratory area will not expose the personnel to unacceptably high radiations.

At the Laboratory, a dilution factor of 1,000 has been used for calculating the permissible release from the 3039 stack*. On the basis of a maximum permissible concentration for the Laboratory population of 3×10^{-10} microcuries/cc of I-131 and using the above-mentioned dilution factor of 1,000, the value of $x\ 10^{-7}$ microcuries/cc is calculated as the maximum permissible average concentration in the stack so that internal dose from stack release will not exceed one-tenth of the maximum allowed from the total occupational exposure. During the last quarter the Laboratory averaged about one-tenth of this value or 3×10^{-8} microcuries/cc. On the basis of this data it appears that a release of 12 curies/week would be acceptable; the Laboratory actually releases less than 2 curies/week**.

----

(1) Preliminary draft of Federal Council Report No. 2, Selected Radiation Guides, March 20, 1961.

* This figure was obtained from a report by R. F. Myers and D. R. Purdy, U. S. Weather Bureau, July 1, 1957.

** See Appendix A.

The second report of the Federal Radiation Council (dated March 20, 1961, Selected Radiation Guide) will be published in the near future. The "intake guide" used in this report is quite different from previous regulations listing the allowable radioactivity intake of maximum permissible concentrations.

The following classification is used*: Range 1 includes intake of 0 - 10 micromicrocuries/day. Under normal conditions no appreciable segment of the population based on young children will reach the maximum intake value. The required surveillance involves only spot samples to guarantee that the levels are not exceeded. Range 2 includes average releases resulting in intakes of 10 - 100 micromicrocuries/day by children and may be expected to result in a few individuals approaching the RPG. For this classification the surveillance should yield a higher level of confidence. The environmental values must be steady; physical, chemical and metabolic data must be available. Proper regard must be given to sampling average daily intake of small children who represent the most sensitive element of the population. Range 3 includes the 100 - 1,000 micromicrocuries/day intake level. The actions taken must ensure that the trend is reversed and the release goes back to one of the lower classes. A sharply rising level requires immediate action.

In summary: Range 1 requires only spot sampling to ascertain that there is no cause for concern; Range 2 necessitates more sampling to make sure there is no upward trend; Range 3 requires action to reverse the trend and to lower the activity. The data are averaged for one year.

These new intake criteria recommended by FRC require re-evaluation of the Laboratory stack release control levels. In order to arrive at an estimate of the allowable I-131 release rate from the total ORNL stack system it is necessary to make a series of assumptions connecting the I-131 stack release rate with the food chain (principally milk) via meteorological dispersion, deposition on pasture grasses, and ultimate secretion in the milk of cows grazing on the grass.

Estimates of the effective residence half-life of iodine on pasture grasses have ranged from 5 days to the radiological half-life of I-131. For convenience, an effective half-life of 7 days was used as the basis for calculations. Assuming a uniform I-131 release rate, it is calculated that the equilibrium amount of iodine on the grass will be equal to 10 times the daily deposition. On the basis of data collected following the Windscale incident it is assumed that for every 10 micromicrocuries of I-131 deposited on one square meter of grass about 1 micromicrocurie will be secreted per liter of milk. The daily milk consumption of a young child is taken to be 1 liter. It was further assumed that the average annual iodine release rate would be the same as that observed during the period from April 24 to August 7, 1961, namely 2.8 microcuries of I-131 per second. Assuming an average deposition velocity of 0.04 meters/second for iodine onto grass, and using average annual meteorological data and dispersion estimates obtained by W.H. Culkowski,

----

* The substance of the Federal Radiation Council's Report No. 2 was signed by the President and was published in the Federal Register on September 26, 1961.

the 100 micromicrocuries/liter of milk (or 1,000 micromicrocuries/square meter of grass) isopleths may be located. On the basis of assumptions, portions of the city of Oak Ridge, as well as some private grazing lands in the vicinity of the Melton Hill Dam project, are expected to fall in Range 3, and the area for Range 2 would extend almost to Knoxville. Accordingly, the present release rate of 1.7 curies of I-131 per week is about the maximum that may be maintained for long periods of time.

Other factors can modify this estimated release rate to produce, perhaps, a more realistic release criteria. The factor of decreasing pasturage and increased supplementary feeding during winter months might increase the rate by a factor of about 1.25. However, in order to ensure that the anticipated levels on private lands will not exceed the limits of Range 2, the rate should be reduced by about the same factor as the above listed conditions would increase it.

Probably the largest single adjustment for calculating the allowable release rate is needed to correct the fraction of the total deposited iodine on the sampled portion of the pasture grass. The sampling included direct determination of the deposited iodine by health physics monitors and analysis of the milk of the grazing cows. During the period from August to December 1960 the Health Physics Division Technology Section collected and analyzed 52 grass samples from 10 sampling stations within 6 miles of ORNL, and weekly predictions of I-131 levels on grass were calculated from the basic meteorological data. The average amount of I-131 recovered on the grass sample was 40% (std. dev. = 19) of the predicted amount. If this factor is used, the estimated maximum average release rate of I-131 ensuring that private lands will not exceed the upper limit of Range 2 is about 4 curies of I-131 per week (see Appendix B).

Hazards Discussed and Safeguards Suggested

How is the monitoring performed?

> Hundreds of cattle thyroids and grass samples have been collected and analyzed for I-131. While this type of monitoring is not definitive, it indicates trends. In addition, milk samples have been collected from cattle grazing on the UT-AEC Farm pasture areas which were expected to have more I-131 than the nearest private lands. The milk samples contained less than 50 micromicrocuries of I-131 per liter. Milk samples collected from areas beyond the Clinch River were not analyzed routinely for I-131, but the generally low levels of I-131 on grass in those areas were taken as an indication that the I-131 content of milk was below the limit of detectability on a routine basis, thus being in Range 1.

Exactly what steps must be taken if the prediction indicates that an installation might be in Range 3?

If the Range 3 area includes private lands, then corrective actions are required, lowering I-131 levels in the environment to ensure that the upper level of Range 2 will not be exceeded. This involves quantitative environmental surveillance and the application of effective control measures.

Can the iodine be ingested from sources other than milk?

A certain amount may find its way through leafy vegetables but this path is rather minor.

Is the situation considered to be serious?

At present this is considered a borderline case but if the iodine release is further increased careful steps should be taken.

How can it be ascertained that the limit is not exceeded?

It is proposed to enter into a cooperative agreement with a childrens' clinic, asking the pediatricians to take a thyroid count of the children during their regular physical checkup, thus accumulating data from a large number of children at various ages. Arrangements should also be made with meat packers to measure the thyroid count of cattle. Milk samples should be obtained from the area checking them regularly. In the case of both the childrens' thyroids and the milk the limits of detectability with present methods are probably reached. It should be kept in mind that many children use canned milk which does not present an iodine problem.

What variations are allowed from the average?

If individual cases do not exceed 3 times the average intake level calculated from the intake guide number the situation is considered acceptable.

What is the equilibrium concentration in the body when the individual inhales one-tenth MPC of I-131?

A. C. Chamberlain (A.E.R.E. Harwell) estimated that 10^{-4} microcuries/gram of grass (about 0.1 microcuries/m^2) would be found after equilibrium with 10^{-12} microcurie/cc of air. The FRC intake guide (upper limit of Range 2) corresponds to about 10^{-3} microcuries/m^2, i.e., a factor of 100 less than Chamberlain's values. Thus a level of 10^{-14} microcurie/cc would be expected to produce 1,000 micromicrocuries/m^2, finally resulting in 100 micromicrocuries I-131 per liter. The deposition on the grass rather than the air concentration controls the permissible level.

No actual data are available for humans but in case of cattle the intake continues to increase for 3 or 4 days and then it levels off. It is assumed that the situation is similar for humans.

Is there any inconsistency between the airborne MPC and the activity on the grass?

The two figures are comparable; the same thyroid activity will result from either definition.

Are there any attenuating circumstances concerning the release?

Fortunately the milk originating from the cattle in the restricted area is not sold otherwise the whole restricted area definitely would be in Range 3.

How does the change in ruling on the stack release affect the Laboratory's operation?

The meteorological conditions were not considered before; according to the new ruling it has to be taken into account and the Laboratory must check persons and animals to make sure that the conditions are met.

Are there any other questions which must be considered in this connection?

The weapons tests started recently by Russia might cause a further reduction of the permissible release of the individual installations.

Are the maximum values well established at the present time?

These values must be tied down more precisely. The Federal Radiation Council's ruling signed by President Eisenhower has the force of law for federal agencies. Before these figures are published they are discussed and the data are made available in the form of pre-publication copy. The guide advises that if the federal agencies cannot comply with specific questions the limiting values may be exceeded but the decision must be carefully documented.

What is the situation at the national laboratories?

On the basis of an informal review it has been found that radioactive releases at all the national laboratories do not exceed the proposed new limit.

Where does the iodine originate?

Probably most of it comes from the processing of I-131 in the Isotopes Division but a certain amount in the atmosphere in Oak Ridge must originate from Abbott Laboratories which also processes radioiodine; however, their contribution is not known at present.

Are these sources of radioactive iodine released into the atmosphere definitely proved?

Only circumstantial evidence is available at present; the monitoring program must be continued in order to ascertain the source of every release. However, the data allow to draw the conclusion that the Laboratory's iodine release to the atmosphere is very close to the maximum permissible level.

Was the HRT stack also checked?

During the operation of the reactor the stack contributed a certain amount of radioiodine. While the evidence is incomplete, in the opinion of the Operations Division's personnel it was much less important than the 3039 stack.

Does the release to the atmosphere coincide with iodine operational runs?

There is a definite correlation as it was shown in the previous meeting of this Committee*. As a general rule the iodine release occurs after the run when the waste lines are vented.

What steps are taken to prevent the escape of iodine?

A charcoal adsorption unit was placed in the system. On the basis of work performed at Hanford it is estimated that this unit has 99+ efficiency for about 100 ppm iodine. On the other hand, the iodine concentration is by a factor of about one billion less and only a 50% efficiency obtained.

What is the path of the iodine released to the stack?

In the past the bulk of the iodine at the Laboratory used to come from the cell ventilation system, more recently most of the iodine originates at the vessel off-gas system. As a general rule, nothing can be done with the material in the cell ventilation system.

How are these streams purified?

The cell ventilation stream goes through an absolute filter and a charcoal trap while the vessel off-gas goes through a scrubber. The new caustic scrubber has been in operation for about 6 months but its efficiency is not known; it probably removes 98 to 99% of the iodine but at least a sizeable fraction of 1% still goes through. The effluent stream then reaches the Operations Division's scrubber but it is so diluted at that point that the removal efficiency of the residual contamination is probably quite reduced.

What is considered to be the best method to remove the iodine from the waste stream?

As mentioned above, work performed at Hanford indicates that only charcoal can be used for this purpose.

----

* See Minutes of Meeting Held on August 21, 1961 and page 8 of these Minutes.

Committee: Waste Effluents
Meeting Date: September 5, 1961
Subject: Gaseous Waste Disposal at ORNL, Part II

Are experimental data available correlating the air activity with processing work at the Laboratory?

One such set of measurements representing the activity on the membrane filter of the charcoal cartridge placed at the bottom of the 50-ft sample line connected with the 3039 stack is presented on the graph in Appendix C which shows the correlation between activity and time. The dates of July 10 and July 17 represent the start of an iodine processing run in the isotopes area. The graph shows that during the first 9 days of the month no noticeable activity could be detected. An increase can be noted on the 10th, tapering off during the week and showing another peak on the 17th. Another high activity peak noted on July 21st correlates with a distillation process in the iodine plant. On the same two days short-lived fission products were also processed together with the iodine. In all, the measured values account for more than 99% of the iodine-131 activity.

What amounts of iodine-131 are processed in each run?

About 200 to 300 curies are processed in each run.

Could this figure be reduced in order to avoid these activity peaks?

The present batch size was adopted for economical reasons; a drastic reduction of the batch size would remove the Laboratory from the iodine supply business. In addition it should be remembered that the purification factor decreases with decreasing amounts.

What can be expected if the iodine release rate is greatly increased as a result of the increased nuclear power operations? Isn't it probable despite the improved cleanup methods the actual amount released to the atmosphere will continue to increase beyond the permissible level?

When that point is reached the industry will probably take over a large portion of all the iodine business and the production will not be concentrated in the Oak Ridge area.

What is the present situation at the Abbott Laboratories?

The details of the process used by Abbott Laboratories are not known. They irradiate their material at the Westinghouse reactor. The iodine is discharged essentially at ground level resulting in a higher concentration but less spreading compared to a release from a high stack. It is not known how successfully the iodine is scrubbed out from the waste stream.

Is it possible that other sources at the Laboratory release I-131 into the atmosphere?

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: September 5, 1961
Subject: Gaseous Waste Disposal at ORNL, Part II

This cannot be established definitely at the present time.

Could the air stream be sampled before the scrubber?

Although feasible such an operation presents technical difficulties.

Do the data obtained by Health Physics and Operations Divisions agree?

The Health Physics Division data are consistently higher because most of the causes of sample loss have been eliminated. In the old sampling method a significant portion of the iodine, ruthenium and some other components were lost because of the great length and abrupt bends of the sampling tube.

Is only the I-131 considered in the survey?

No, others are also considered (see Appendix A); however at present I-131 is considered the controlling radionuclide.

Submitted by Francois Kertesz
Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

November 24, 1961

FK:bMcH

Attachments

TX-2705 (1-61)

LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents
Meeting Date: September 5, 1961
Subject: Gaseous Waste Disposal at ORNL, Part II

Distribution:
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
C. J. Borkowski
K. B. Brown
F. R. Bruce
T. J. Burnett
G. C. Cain
A. M. Carlson
T. F. Connolly
J. A. Cox
B. R. Fish
J. H. Gillette
J. C. Hart (4)
J. H. Holladay
C. E. Haynes
T. W. Hungerford
W. H. Jordan
F. Kertesz
D. J. Knowles
E. Lamb
J. F. Manneschmidt
M. L. Nelson
D. Phillips
R. A. Robinson
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

APPENDIX A

INTRA-LABORATORY CORRESPONDENCE

Oak Ridge National Laboratory

August 18, 1961

TO: W. H. Jordan, Chairman
Waste Effluents Committee

FROM: B. R. Fish

SUBJECT: Tabulation of 3039 Stack Monitoring Results for the Period Between April 24, 1961 and August 7, 1961*

Presented in Table I is a tabulation of the first three months of 3039 stack monitoring results. The exponent beneath each nuclide symbol is to be multiplied by the table value to obtain the concentration of each radionuclide in $\mu c/cc$.

The concentration values in Table I are calculated from analytical results assuming uniform release throughout the sampling period. Since this may not be a completely correct assumption, some limits of accuracy are presented in Table II for the most frequently occurring nuclides based upon a sampling period of one week.

Table III lists the estimated amounts of I^{131} released per week from the 3039 stack. Between April 24 and August 7, 1961, there was an average of 1.68 curies of I^{131} released per week.

* Data obtained by J. W. Youngblood

JWY:pc:bMcH

Attachments (3)

TABLE I - TIME INTEGRAL CONCENTRATION* OF RADIONUCLIDES IN 3039 STACK EFFLUENT

Sampling Period -1961-	Co^{60} x10^{-12}	Sr^{90} x10^{-12}	Y^{91} x10^{-12}	Zr^{95} x10^{-12}	Nb^{95} x10^{-12}	Ru^{106} x10^{-12}	I^{131} x10^{-8}	I^{133} x10^{-11}	I^{135} x10^{-11}	Cs^{134} x10^{-11}	Ba^{140} x10^{-12}	La^{140} x10^{-12}	Ce^{141} x10^{-10}	Ce^{144} x10^{-12}	Pm^{147} x10^{-12}	Gross+ Alpha d/s
4/24-5/1	-	8.8	21	2.1	2.2	0.49	2.7	-	-	-	0.79	2.1		3.8	24	1
5/1-5/8	-	37	6.7	1.9	0.72	0.59	.92	-	-	-	39	101	1.3	1.2	170	1
5/8-5/22	12.2	6	7.8	20	9.5	5.4	3.9	-	-	-	-	-	-	2.1	19	8
5/22-6/5	SAMPLE LOST															
6/5-6/12	6	5.6	-	2.5	1.8	2.1	4.7	-	-	-	-	-	-	2.1	0.74	4
6/12-6/19	1.9	1.1	2.2	1.1	1.5	1.9	11	7	3.4	-	-	-	-	2.5	-	4
6/19-6/26	1.5	3.9	0.73	1.7	-	0.77	1.3	-	-	-	-	-	-	0.55	1.9	-
6/26-7/3	-	4.6	3.2	-	-	2.5	0.41	-	-	2	-	-	-	0.77	2.3	-
7/3-7/10	2.4	6.8	3.7	-	-	1.2	0.23	-	-	-	-	-	-	0.51	2.9	-
7/10-7/17	6.2	280	-	1.2	2.2	110	3.2	-	-	-	-	-	-	56	170	-
7/17-7/24	6.4	12	-	1.2	3.6	1.8	6.4	-	-	2.4	-	-	-	18	7.6	2
7/24-7/31	6.4	23	-	0.65	1.1	2.9	1.6	-	-	0.9	-	-	-	4.9	4.5	7
7/31-8/7**	-	-	-	-	-	-	8.5	-	-	-	-	-	-	-	-	-

13 week average for I^{131} 3.75 x 10^{-8} μc/cc in 3039 stack

* Concentration in μc/cc x Exponent Beneath Nuclide Symbol.

** No data included except I^{131} for this week.

TABLE II

Radionuclide	% Deviation of Calculated Time Integral Concentration from Actual Average Weekly Concentration. (Maximum Range)
Co^{60}	± 1%
Sr^{90}	± 1%
Y^{91}	+ 4%, -5%
Zr^{95}	± 4%
Nb^{95}	± 7%
Ru^{106}	+ 1%, - 0.4%
I^{131}	+33%, - 27%*
Cs^{134}	± 1%
Ce^{144}	+ 1%, - 3%
Pm^{147}	± 1%

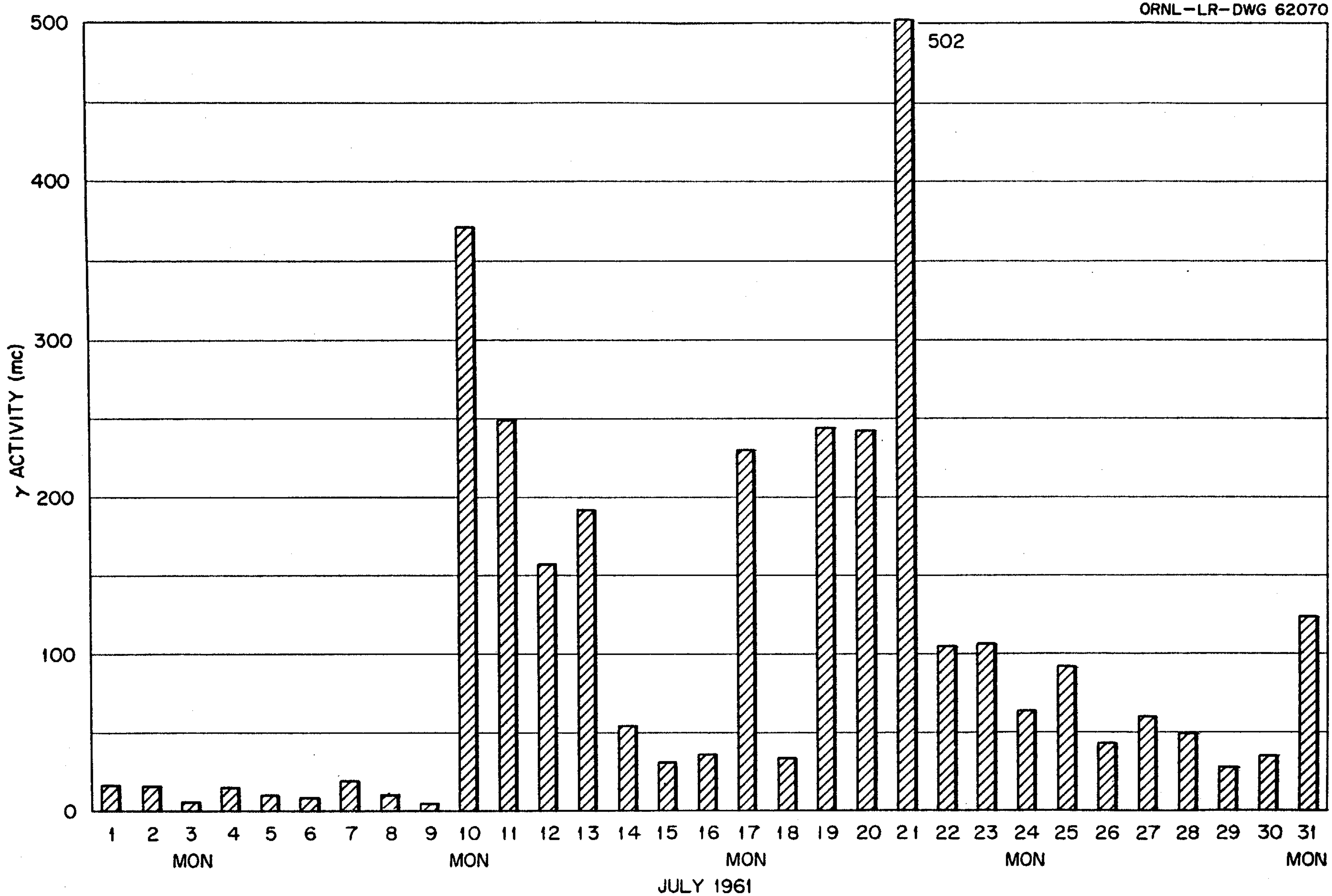
*Observation of daily samples indicates that the I^{131} release rate is sufficiently distributed throughout the week that the likely error in assuming uniform release is of the order of ± 5%.

TABLE III

ESTIMATED DISCHARGE OF I^{131} PER WEEK FROM 3039 STACK

SAMPLING PERIOD -1961-	I^{131} RELEASED (Curies/Week)
4/24 - 5/1	1.06
5/1 - 5/8	0.36
5/8 - 5/22 (Average for 2 weeks)	2.98
5/22 - 6/5	Sample Lost
6/5 - 6/12	1.82
6/12 - 6/19	4.24
6/19 - 6/26	0.53
6/26 - 7/3	0.16
7/3 - 7/10	0.09
7/10 - 7/17	1.23
7/17 - 7/24	2.50
7/24 - 7/31	0.62
7/31 - 8/7	3.34
13 Week Average	1.68

UNCLASSIFIED
ORNL-LR-DWG 62070



Daily Activity Discharge, 3039 Stack; Month of July, 1961.

APPENDIX B

INTERPRETATION OF AVAILABLE I-131 ENVIRONMENTAL MONITORING DATA*

B. R. Fish

The estimate of 4 curies/week, would indicate that the city of Oak Ridge and other areas of concern are probably not in Range 3 but more likely in Range 2. These conclusions are supported in part by the results of the analysis of numerous grass samples and of a few milk samples, collected from the relatively small areas concerned. Although the average daily I-131 intake of the most exposed members of the general population lies probably not higher than about in the middle of Range 2 (as a result of ORNL operations), nevertheless, in view of the many uncertainties in the required chain of assumptions it is advisable to hold the average release rate down to or below the present value of about 1.7 curies of I-131 per week. Since a rather large area may be in Range 2 and because it seems likely that the Laboratory will be required to comply with the recommendations of the FRC, the Applied Health Physics and Health Physics Technology Sections have already initiated an expanded milk and grass sampling program and have increased the sensitivity of their routine methods for I-131 analysis so that samples indicating the lowest range, Range 1, can be identified.

* These estimates may be modified in light of more complete environmental data to be collected in an expanded I-131 monitoring program.

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: September 19, 1961 **Code Number:**

Present:

Members

W. H. Jordan, Chairman
T. A. Arehart
W. A. Arnold
K. B. Brown
F. Kertesz
E. Lamb
M. L. Nelson

Experimenters or Operators

General Discussion of Radioactive Waste Disposal Programs

Chairman Jordan announced that this session will be devoted to a general discussion of information collected during the previous sessions. This will give Committee members an opportunity to express their opinions before the Committee winds up its activities for this year by preparing recommendations to management.

Liquid Radioactive Waste Disposal

Satisfaction was expressed with the report that all the liquid radioactive waste of the Laboratory is now discharged into trenches and no liquid is sent to the open pits. It was also noted that very little ruthenium is released into the new trenches. This favorable situation is probably due to several factors: the amount of ruthenium released is greatly reduced because the pilot plants are not in operation and part of the ruthenium is held back in the chemical treatment plant and settles out in the ponds. The amount of high-level waste still reaches about 7,000 gallons per month.

Although it cannot be actually proved which areas are responsible for the balance of radioactive materials released to the waste system it is hoped that the situation will be much clarified when the monitors are installed as planned.

The continuing seepage from Pit 4 will probably be solved only when the filling operations of the pit are completed. The high rainfall this spring complicated the problem. Use of concrete to bind the residual water chemically might be desirable from technical viewpoint but it is not economically feasible. Present plans call for filling the pits with dirt and shale. It is hoped that the whole operation can be completed in one year.

At the time of last year's review a request was made to evaluate the usefulness and life expectancy of concrete tanks. This evaluation has not been received by this Committee.

Solid Radioactive Waste Disposal

At the time of the last review of the solid radioactive waste disposal program* the Committee expressed some concern that as much as 5 acres of ground are used up every year. Cost estimates of the expenses involved in reducing the volume of the solid waste and incineration prior to burial were requested at that time. According to recent studies the estimate of 5 acres per year is somewhat exaggerated; this figure is due primarily to the large amount of rubbish resulting from the 3019 accidents at the end of 1959. The current estimates are revised downward to about two acres per year.

At present the Laboratory serves as the only radioactive solid waste disposal area for the whole eastern part of the United States. The situation could become even more pressing when large scale power reactor operations start. On the other hand, a new eastern burial ground will be made available within one year in New York State; this should considerably reduce the load of ORNL solid waste disposal area as about 50% of the solid radioactive waste originates from off-site at present.

According to present studies, disposal in salt mines appears to be very promising; however, the ground must be government-owned.

The present plan is to survey all the facility and burial areas in Melton Valley setting aside areas especially suitable as construction sites releasing the areas between these sites for burying radioactive waste. The purpose of this study is to avoid using up conveniently located good building sites in the immediate vicinity of the Laboratory. If it appears that the eastern burial ground will indeed be in operation within a reasonable time the incineration studies will not be strongly pursued because there will be much less economic necessity for such operations.

Removal of solid radioactive waste from the Laboratory site to the burial ground is well regulated. Plastic-lined yellow cans are used for collecting the material. When the can is filled the liner is sealed and a metal top is put on the can. The can is then checked by a health physics surveyor. Unfortunately, the rules are occasionally violated.

It was agreed that although the solid radioactive waste disposal methods were reviewed quite extensively last year it appears desirable to obtain additional information on this subject.

Gaseous Radioactive Waste Disposal

Referring to the gaseous waste disposal practices of the Isotopes Division** it was pointed out that after a recent run only negligible amounts of iodine was

---

* See Minutes of Meeting Held on September 12, 1960.
** See Minutes of Meeting Held on September 5, 1961.

found on the filters while the caustic solution in the second scrubber (which is used primarily as a back-up for the system) contained only 50 to 80 millicuries of iodine out of a total of 8 curies processed during the run. This indicates a very good efficiency for the system and no further substantial improvement can be expected.

Several Committee members agreed that the gaseous radioactive waste disposal was markedly improved since last year; however, it was pointed out that the situation will be even more unfavorable when the new Federal Regulation reducing the maximum permissible levels for iodine by a factor of about 30 becomes effective.

It was pointed out that the gaseous waste disposal program involves the cooperation of several divisions such as Operations, Isotope, Instrumentation and Controls, Health Physics, and Chemical Technology Divisions. In order to ensure cooperation of these groups, C. Chester was recently appointed to coordinate the various phases of the program. The currently available technical data are spotty and cannot be used for meaningful management decisions.

It will be attempted first to put the available instrumentation in good operating condition, assessing the data collected at least qualitatively in order to establish the time of the release with reasonable certainty. It is hoped that at a later time quantitative determinations and even detailed isotopic analyses of the released materials can be obtained.

Development of a proper sampling technique presents the chief difficulties. Three holes provided with probes are available at the stack. If the dimensions of these probes are incorrectly chosen or if the suction is not suitable, it is possible that some of the material and the sampling instrument will receive only the fine fraction but not the heavy particulate material. The detecting instruments themselves are considered to be in good order but the data obtained are unreliable because of this difficulty of obtaining representative samples. It is hoped that these questions will be solved by the new coordinator.

Plans are being made to build a water-tight scaffolding and shelter at the stacks in order to protect the instruments against rain. Duct monitors will also be installed to identify the parties who released radioactivity to the stack. While in some cases nothing can be done about it at the time, it is hoped recurrence of such practices can be thus prevented.

The qualitative instruments are ready for installation although details of the quantitative system are not available yet. Unfortunately shortage of craftsmen prevent the complete installation of the system. A vigorous management support is needed for obtaining the priorities needed to install the equipment. Although emergency work orders should be used only for safety equipment the great manpower shortage in the shops force the Laboratory to use a complicated system of priorities. It was felt that the Committee could lend assistance by recommending a high priority for this project. It was pointed out that even though the first phase of the monitoring system is only partially installed, the Laboratory in general has a much better gaseous waste monitoring system than other AEC installations.

Committee: Waste Effluents
Meeting Date: September 19, 1961
Subject: General Discussion of Radioactive Waste Disposal Programs

The fallout monitors operated by the Health Physics Division are very useful for detecting the activity released, but the data are available only after a lapse of time and are more useful for confirming facts than controlling the release.

While the filters installed reduced considerably the particulate activity there are no sufficient data available to define the dangerous concentration of particulates in air.

The preliminary recommendations and conclusions reached during the deliberations of the Committee will be discussed at the time of the final meeting at which time the final recommendations to management will be prepared.

Submitted by W H Jordan for
Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

October 13, 1961

FK:bMcH

Distribution:
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
K. B. Brown
F. R. Bruce
G. C. Cain
T. F. Connolly
J. A. Cox
J. C. Hart (4)
C. E. Haynes
T. W. Hungerford
W. H. Jordan
F. Kertesz
E. Lamb
M. L. Nelson
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

Committees

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

November 14, 1961

To: F. R. Bruce

Re: Waste Effluents Meeting of October 3

In reading the excellent minutes of the meeting on the solid waste burial ground, I am struck by the land hunger of this operation. At the present rate of burial, how long would it be before we have no land left? Doesn't it seem to you that the matter of compacting the solids is rather urgent?

ORIGINAL SIGNED BY
ALVIN M. WEINBERG

Alvin M. Weinberg

c

cc: F. Kertesz
J. A. Swartout

9AS

TX-2701 (1-61) **OAK RIDGE NATIONAL LABORATORY**

LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: October 3, 1961 **Code Number:**

Present:

Members	Experimenters or Operators
W. H. Jordan, Chairman	T. A. Arehart
W. A. Arnold	F. N. Case
G. C. Cain	J. R. Gissel
F. Kertesz	A. F. Rupp
E. Lamb	W. M. Stanley, Jr.
M. L. Nelson	

Operation of the Solid Waste Burial Ground

Case reviewed the procedure of disposing solid waste at ORNL. The Laboratory serves as regional burial ground for three types of radioactive waste suppliers: the licensees who obtained permission to use radioactive isotopes, federal agencies and the "cost plus" type AEC contractors. As a result of the wide publicity of this fact the number of shipments which used to be fairly constant showed a sudden increase as the operators found an opportunity to get rid of waste which in some cases was accumulated for many months or even years. Variation of the amount of waste received is due to the practice of the large "cost plus" contractors such as Argonne and Knolls which send their radioactive waste semiannually to the Laboratory for disposal. The same thing also applies to several federal agencies and the armed forces.

About half of the waste comes by rail and the other half by truck. Shipment by truck is much more convenient from the viewpoint of actual disposal; on the other hand, rail shipment is quite advantageous for people who handle large volumes of accumulated radioactive materials.

The nature of the material is quite variable: the shipments may include low-level materials such as contaminated paper, packed in 55 gallon drums, or ion exchange columns from an army package reactor which, with its shield, may weigh as much as 20 tons and requires special handling equipment.

It has been noticed recently that several state governments are interested in establishing their own burial grounds in order to attract nuclear industry. Positive steps have been taken already by New York and Kentucky; in addition, Illinois recently passed regulations allowing radioactive waste disposal within the state.

The Laboratory charges $0.70/ft^3$ to the licensees and $0.50/ft^3$ to the federal agencies and the "cost plus" type contractors. Most of the material comes from the latter group. Liaison between the customers and the Laboratory acting as burying agent is very satisfactory; the shipments are routine and do not present special problems.

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: October 3, 1961
Subject: Operation of the Solid Waste Burial Ground

In order to take advantage of this service the customer must fill out a standard waste disposal order form in triplicate. In the order form, the nature of the waste is described indicating whether it is loose or compacted, whether it contains paper, rags or similar combustible materials. The type of packaging is also indicated and it is stated that the material is not explosive and not reactive; in particular, that it will not react with water. The isotopes contained and the curie level of the shipment are also indicated. Materials which present special hazards such as potentially explosive or reactive materials including zirconium metal powder, uranium chips, NaK, etc. are not accepted for burial. The answers and statements are reviewed at the Laboratory and accepted in the name of the Commission. If the shipment appears to be questionable other means are proposed to provide relief to the customer.

Hazards Discussed and Safeguards Suggested

What steps are taken to dispose of potentially explosive or reactive waste material?

> Such materials must be made non-reactive by the shipper before they can be accepted.

Does the income from the disposal operations cover the cost?

> During the last year a profit of $58,900 was realized, so the operations can be considered as moderately lucrative.

Is it expected that this profit will continue?

> Whenever profit is shown, there is a pressure to reduce the cost. It should be emphasized that the cost figures do not include depreciation and several other factors.

What is the motivation for establishing a regional burial ground here?

> Inasmuch as the AEC is in the radioisotope sales business, it must provide a corollary in the form of a disposal ground, and until states take over, long-term controlled land (such as federal sites) must be utilized.

Has reactor waste been considered?

> At present most of the contributors are isotope users; however, it is expected that with the advent of power reactor operations the radioactive waste of reactors will become much more important.

Have other sites been considered for the Eastern Burial Ground?

> It is hoped that other places will be found because the local problem is very pressing. Although western salt mines were seriously considered no actual new burial grounds have been opened until now.

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: October 3, 1961
Subject: Operation of the Solid Waste Burial Ground

What percent of the solid waste buried originates outside of the Laboratory?

At present the distribution is about 50% from ORNL and 50% from the rest of the eastern part of the United States.

Are these percentage figures based on curie level or on weight?

It is the practice in solid waste disposal to measure everything by volume.

How does the cost of the business compare during recent years?

During 1959 the cost was about $60,000 against an income of $40,000; in 1960 the cost went up to $70,000 and the income to $60,000 while in 1961 the income is estimated at $150,000 and the cost at $90,000.

Have difficulties been experienced with reactive materials?

There was a sodium fire at the burial ground about three years ago. Since then no problems have been encountered probably because of the careful review of the material prior to shipment.

Are the operational details presented in writing?

The policy of operation is being prepared jointly by the Engineering and Mechanical and the Health Physics Divisions. It will be published probably in the Health Physics Manual.

What is the present status of radioactive waste disposal at sea?

There is a great pressure against sea disposal in Congress. In addition, it was found that the stricter packaging requirements make disposal at sea more expensive than land burial. Several commercial firms involved in the collection of radioactive waste stated they started making profit only after the Oak Ridge burial ground was made available.

It should be mentioned, however, that there is a wide area of disagreement on this subject as evidenced by the fact that the British pump their radioactive waste two miles out from land into the Irish Sea. Strong political pressures would make such an operation impossible in the United States.

What other burial sites are available in the United States?

The only other large burial area is located in Idaho. Another one is available at Hanford but it is reserved exclusively for the local waste. Hanford Engineer Works recently entered in negotiation with a neighboring Indian tribe to purchase some of their tribal land for burial.

Committee: Waste Effluents
Meeting Date: October 3, 1961
Subject: Operation of the Solid Waste Burial Ground

What alternate waste disposal methods are under consideration?

Some testing and experimentation is carried out at Los Alamos, in Philadelphia and at the Argonne and Brookhaven National Laboratories on incineration techniques while at ORNL compacting studies are pursued. There is great need to enlarge the scope of these studies but unfortunately no research and development funds are available at present.

Are these studies promising?

If successful, quite probably the waste originating both from the Laboratory and from outside sources could be compacted to about 10% of its original bulk thus considerably reducing the burial area requirements. If stronger financial support will not be forthcoming it will be attempted to find commercially available machines to do this work.

Has consideration been given to establishing burial grounds elsewhere?

The western landlocked states represent an ideal spot for burial grounds but transportation to the remote locations is too expensive. In order to be competitive the volume of the waste must be first reduced by incineration or compacting before the material is transported to western disposal areas. The great distance affects the cost to a greater extent than packaging because the truck transporting the waste must come back empty.

Were shipments arriving at the Laboratory refused because of improper packaging?

Although such a condition causes difficulties at the Laboratory, no shipment is refused; it is deemed that more problems would be created by refusing the shipment than by accepting the improperly packaged material. As a general rule it can be stated that the shippers of radioactive waste are quite cautious.

During the last yearly review it was found that well monitoring indicated that only a very small amount of radioactivity found its way into the wells. Has this situation changed during the past year?

The activity that finds its way into the wells is extremely small - less than 1 curie. No trouble is expected to originate from Burial Ground No. 5 because the material received has been carefully buried.

Do special problems arise during the disposal operations?

Although in principle reactive materials are not accepted, liquid metals must be disposed occasionally. As the nature of the material is known ahead of time it is sent to an isolated area in a steel can provided with a vent and will be allowed to oxidize slowly in about two years. Such special handling, however, is very costly.

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: October 3, 1961
Subject: Operation of the Solid Waste Burial Ground

Did any problems arise in choosing the area of the burial ground?

The location of Burial Ground No. 5 was recommended by Health Physics Division experts who indicated that it has the required underground strata for disposal. However, although it represents an ideal spot for a burial ground, C. E. Winters pointed out that that area is too valuable to be wasted for burial only in view of the fact that the Melton Valley area is being developed as a reactor site and radiochemical operations area. After the Fast Burst Reactor is completed there will be two bare reactors (the TSR being the other one) in this region thus necessitating a large exclusion area. The HFIR, the MSRE (in the old ARE Building) and the Transuranium Facility (TRU) will also be located in the immediate vicinity.

In order not to sacrifice otherwise suitable locations by using them for burial of radioactive waste, the Engineering and Mechanical Division reviewed the rest of the area draining westward and found nine sites which are suitable for reactors or high-level radiochemical plants. Tentative plans would place the pebble bed reactor in this general area, bordering on a corner of Burial Ground No. 5. For this reason, it was decided not to use that corner of this burial ground thus removing about 30% of the original area assigned for burial. The rest of the burial ground will continue to be used.

Have other areas been surveyed for this purpose?

The Engineering and Mechanical and the Health Physics Divisions reviewed the whole area outside of the new TVA fence. About 50 acres, sufficient for about 10 years at the present consumption rate, have been set aside and will be carefully studied by drilling test holes. In about two months more specific recommendations can be made on the basis of the data obtained from these drillings.

Is it planned to use the areas between the reactor sites for burial?

Such areas would be used only as a last resort for burial. A circle with 1000-ft radius will be left in every direction.

Has the drainage of this area been reviewed?

All the planned facilities will be within the Melton Valley (White Oak Creek) water shed. Beyond the water shed toward the east an area has been reserved by AEC for possible future power reactors.

Would new construction activities cause problems at the burial areas?

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: October 3, 1961
Subject: Operation of the Solid Waste Burial Ground

It is known that the State Highway Department intends to reline the White Wing Road from the bridge to the Turnpike. Special care will be taken not to infringe on areas set aside for ecological studies and for waste disposal.

Recommendations:

The Committee recommends to place a greater effort on compacting and incineration studies. Successful solution of this problem would result in great savings of valuable land areas and accordingly it is felt that this field deserves greater support than it is given at present.

Submitted by Francois Kertesz

Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

November 8, 1961

FK:bMcH

Distribution:
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
K. B. Brown
F. R. Bruce
G. C. Cain
F. N. Case
T. F. Connolly
J. A. Cox
J. R. Gissel
J. C. Hart (4)
C. E. Haynes
T. W. Hungerford
W. H. Jordan
F. Kertesz
E. Lamb
M. L. Nelson
A. F. Rupp
W. M. Stanley, Jr.
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

TX-2701 (1-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents

Meeting Date: October 17, 1961 **Code Number:**

Present:

Members	Experimenters or Operators
W. H. Jordan, Chairman	J. A. Cox
W. A. Arnold	G. A. Cristy
K. B. Brown	W. DeLaguna
G. C. Cain	D. G. Jacobs
F. Kertesz	R. G. Jenness
E. Lamb	L. C. Lasher
M. L. Nelson	S. J. Rimshaw
	A. F. Rupp
	E. G. Struxness

Problems Presented by Leakage from Trench No. 6

Chairman Jordan announced that management requested the Committee to review the situation arising out of the recently noticed leakage of radioactive materials from Trench No. 6.

Cox described the present situation. The trench in question has been in use since September 10. On October 5 sampling revealed the presence of strontium in a seep below the trench. Up to this occurrence none of the earth disposal systems ever failed to retain strontium. The seep occurs about 100 yards below the trench; the liquid seeping through amounts to 0.15 gallons/minute. It is intended to prepare a synthetic soil column by adding clay and shale to the seepage area. Instructions were given immediately to stop release of radioactive waste into this trench. The chemistry of the waste system is currently being studied by S. J. Rimshaw. On the basis of previous studies it appears desirable to add caustic solution to the trenches. As long as this trench cannot be used, Pits No. 2, 3 and 4 will be used again. It is of interest to note that Trench No. 5 which has been in use for more than a year still operates satisfactorily. The reason for this failure might be due to geological or hydrological properties of the region.

DeLaguna reviewed the problem from the geological viewpoint. The recommended location of the trenches was chosen on the basis of experiences gained with the open pits. Reference is made to the "ORNL Seepage Pit Requirements" which was published in the Health Physics Annual Report for July 31, 1957 (ORNL-2384). A copy of these requirements is included in the attachments (received after the meeting).

Pits No. 2, 3 and 4 were located on a ridge with a steep slope east of Pit No. 4. Bed rock in the area of the pits and trenches lies in beds extending east and west and dipping south. Pit No. 1 was used for only a short time and its use was discontinued quite some time ago. Pit No. 2 operates quite well passing 3,200 gallons/day; it contributed only small amounts of ruthenium to the lake. Pit No. 3 passes about 1,000 gallons/day. Most of the liquid moves out in a direction parallel to the bedding of the weathered shale; the unweathered shale below a depth of about 20 to 30 feet is nearly completely impermeable. The side of Pit No. 3 has some limestone ledges which at first were suspected of forming long cracks or channels, but after the pit was filled no such channels were observed. Limestone beds in the pit area have not been responsible for rapid liquid movement but the shale was found to be much more useful for retaining activity than the limestone. If percolation from Pit No. 3 had been more rapid it would have been more successful but it was blocked partially by the location of Pit No. 2.

Pit No. 4 was built below Pit No. 2 and uncomfortably close to the steep bank to the east. While there was some concern about this location, in view of the acceptable operation of the other two pits the location was approved; however, a "patrol road" was built below it in order to monitor for possible seeps. Observation wells were built in this area both before and after the pits were in actual operation. After the pits had been in operation for some time these wells showed the presence of ruthenium and a small amount of cobalt.

Evidence was obtained later that Pits No. 2 and 3 were above the water table when built, however, after the pits were operated for a certain time the water table rose as a result of the seepage and merged with the liquid level in the pits.

Flow from Pit No. 4 was found to be as much as 20,000 gallons/day. The movement of the liquid is both to the east and to the west parallel with the bedding; very little movement of the liquid is observed across the bedding. The end walls contribute virtually nothing to the seepage. Because the waste moves out of the pits in a direction parallel with the beds it appeared logical to build a narrow pit at right angles to the beds, filling it with broken stone. Such a narrow trench filled with stone and covered with dirt would fulfill the same function as the open pits while reducing the radiation field, which on occasion has reached 5 r/hr around the open pits. On the basis of these considerations we recommended a nearby ridge which had a level top and at this site a narrow trench (Trench 5) was dug to a depth of 15 feet. This was filled with rock covered with dirt and when placed in operation performed satisfactorily. Since the trench was put in service the water table level has risen by 10 to 15 feet but it is still well below the level of the trench.

In order to study the distribution of activity around the pits auger holes were drilled 5 feet from the edge of Pit No. 2; later similar holes were drilled opposite Pit No. 4. Sampling the liquid in these holes showed only very small amounts (a few counts per minute) of cesium or strontium; however, it should be emphasized that sampling by means of auger holes does not give the data for a complete, quantitative material balance. A detailed report on this attempted sampling is in preparation.

When Pit No. 4 is completely abandoned and filled in, it is expected that the water table will drop. This will leave the strontium and cesium activity suspended in the shale immediately adjacent to the pit and above the water table. This will also be the case with Trench 5; the case of Pits 2 and 3 is uncertain.

Trench No. 5 has operated quite well for over a year taking care of about 1/2 of the intermediate-level liquid radioactive waste from the Laboratory. It was then decided to build another similar one, and a reconnaissance was made of a nearby similar ridge. On the basis of this examination two possible sites for Trench No. 6 were suggested for further study (see attached map). Experience has shown that it is unwise to attempt to estimate the depth of the water table under these ridges and test holes were recommended. One of our test wells near where Trench No. 6 was actually built showed depths to the water table of from 14 to over 20 feet, but the minimum is probably less. In view of the seasonal variations the exact depth of the water table below Trench No. 6 is not known but while it was being dug the shale was dry to a depth of 15 feet. On the basis of past experience it is quite possible that the water table will rise above the bottom of the trench in wet weather, even after the trench is abandoned. The depth to the water table at the suggested locations is greater.

Although some shallow auger holes were apparently drilled, neither the sites suggested nor the test drilling recommended were actually made use of. The first observation wells around Trench No. 6 were drilled after the trench was in service. The first observations were made about 10 days ago (October 5) and the depth of water in these wells (seven) varied from 12 to 18 feet. It was this very shallow depth to water that lead to the search for the seep below the trench, and it should be kept in mind that the highest water table will come in January or February when the weather is rainy and the effect of evaporation is negligible. Also the flow of seep will probably increase materially at this time. There is some limestone in the area of Trench No. 6 but it is unlikely that it contributes materially to the flow of waste to the seep. In checking the various holes very little activity was found in the ones north of the trench but in the three holes to the south quite considerable amounts of activity were noticed.

When the trench was built on this site it was felt that it would percolate through the shale too slowly; actually the present rate is 4,000 to 5,000 gallons/day. The evidence suggests that as the water table came up due to seepage from the trench, the flow was concentrated at a shallow depth into the draw to the south. Logging the holes with a GM probe suspended on a cable shows concentrated flow in this one direction. There is little or no flow through the shale in depth, largely because of the location and orientation of the trench.

If waste continues to pour into this trench the water table will continue to be high and the radioactive materials absorbed on the shale will be soaked and leached annually by the ground water. Geologically the trench has been improperly located; however, potentially favorable locations for trenches are still available assuming that test drilling shows a favorable depth to the water table. Construction of a new properly located trench appears to be more desirable than trying to improve a basically poorly located one. The effectiveness for long-term retention of strontium by attempted remedial action at the seep is problematical.

Although some auger holes were drilled in one of the locations suggested for study no systematic investigations of these areas has yet been made. A detailed topographic map of the area would be desirable. The presently available topographic map was made from aerial photographs but because the area is heavily wooded the topography is not accurate. It should be emphasized that even under the best conditions there is a certain amount of gamble in any trench location, but that careful site selection (including test drilling) can reduce the hazard.

In the discussion it was brought out that the actual choice of the site of Trench No. 6 was made by Engineering and Mechanical Division on the basis of cost estimates. It appears that at that time the possible geological objections were not known to them. A large amount of the $30,000 cost of the trench is due to the construction of the required new pipe line. Construction of the trenches was pushed in order to make them available as rapidly as possible for replacing the open pits. Proposed treatments to improve the present situation include sealing the top and the use of stabilizing compounds.

Lasher gave the curie amount of radioactive materials in this trench: strontium-90, 110; strontium-89, 15; total ruthenium, 52; cesium, 338; rare earths, 130. These amounts are negligible compared to those in the other trenches and pits. In order to make sure that this material will not migrate anywhere else the whole trench will be covered over.

Jacobs reviewed the problem from the chemical viewpoint. Strontium causes the chief concern; the cesium is much less important. Recent pH measurements at the seep showed that the solution pumped out had a pH of 10*. In the past few years these solutions contained an average of 0.2 molar NaOH. Accordingly, the hydroxyl concentration is considerably reduced; the soil acts as a weak acid buffering system neutralizing the basicity of the solution. The pH value of the Conasauga shale is between 4.5 and 5.2. Addition of 0.2 molar sodium hydroxide solution in the shale will have a neutralizing effect at a considerable distance from the point of introduction. While the hydroxyl concentration of lower pH solution will be lowered much nearer the point of discharge, strontium in the waste amounts to about 100 curies as compared to a total activity of 400 to 500 curies. In the past about 85% of the activity was due to cesium, 1 to 2% to strontium. It is known that whenever the pH value is low the strontium will start to move and it should be remembered that the soil in that area is loaded with calcium. There is too much calcium in the soil to make possible much pickup of the strontium and accordingly any strontium that is already moving will continue to move and will not be retained. However, if the pH is increased to a very high value and the calcium is replaced by sodium then the situation will be reversed. Thus it can be concluded that the trench did not have a good opportunity to perform as planned in view of the pH value of 9.8 at which calcium hydroxide and even more strontium hydroxide are quite soluble. The pH value of the seeps at several hundred feet distance is 4.9. Under these conditions, about 80% of the exchange sites are occupied by calcium and sorption of strontium is low.

The lowering of the pH is due to decaying plants forming humic acid. From the behavior of the cesium it can be concluded that the solution passes through the soil very rapidly resulting in poor contact. This behavior suggests channeling.

---

* Titration indicated a hydroxyl concentration of 0.04 M, corresponding to pH 12.6.

No complete clay mineral analysis of this site has been made yet; in the original pit area the active material consisted mostly of illite. Other shale constituents amounted to about 20%.

With respect to strontium phosphate fixation at high pH values, it should be remembered that the strontium phosphate $Sr_3(PO_4)_2$ is more insoluble than the corresponding calcium salt and so strontium will be taken up. At the lower pH values the compound $SrHPO_4$ is more soluble than the $CaHPO_4$. If strontium containing waste together with phosphate ions are passed over calcium carbonate, apatite will be formed. The calcium carbonate as such will not pick up strontium. Only after the apatite lattice is formed can strontium sorption be initiated. In the present case the phosphate reaction has not proceeded far enough to start picking up the strontium. One way to accelerate this is to add phosphate into the waste before it is released in order to start the first part of the reaction. Rimshaw added that the pits are filled with calcium carbonate. If the carbonate rocks could be coated with phosphate the resulting system would be very efficient. A similar method is used by the French in Saclay. The behavior of this salt is greatly dependent on the pH: increasing the pH value above 10, the retention of the strontium will be improved but not that of cesium.

During the discussion it was brought out that the analysis of the seep is not consistent with the inventory because all the material does not come out and it is difficult to determine the exact concentration held on the shale. The opinion was expressed that the difficulty may be due to a problem arising at the end of the trench. That area could be closed off with a cofferdam.

Cristy presented the results of the seismographic investigations. Unfortunately at present the seismographic method is not as precise as would be desirable. At the time the trench was dug large rock formations were found in the middle of the desired location. In view of the great cost of rock removal seismographic soundings were taken in order to determine the depth of the rocks before starting drilling operations. The instrument based on the determination of the rate of propogational sound waves stops counting after the first shock wave hits the sensor. The depths can be calculated from the difference of velocity of the waves which is about 1100 ft/second in air and 5000 ft/second in solid rock. The soundings gave values of 35 to 50 ft of average depths. In some cases rock was found close to the surface. No consistent readings were obtained throughout the area. The results only allow the conclusion that in certain locations there is some rock close to the surface throwing the seismographic readings off.

Jordan expressed the opinion that it is fortunate the trouble was found so soon. At present the situation does not constitute a hazard but it would if the waste disposal would be continued. He felt that the exact reason for the difficulty and solution to overcome it must be known before the trench can be used again.

Rupp pointed to the great investment represented by the trench and indicated that it would be very desirable to use them up to the limit of their capacity, perhaps to dispose 500 to 1000 gallons per day after a safe limit is established on the

TX-2703 (1-61)

Committee: Waste Effluents
Meeting Date: October 17, 1961
Subject: Problems Presented by Leakage from Trench No. 6

basis of the current investigation. Of course, more data are needed for intelligent action. No more ditches will be constructed for waste disposal. It is hoped that the recirculation system to be installed will help reduce the volume of the waste effluents and improve the situation.

The public relation aspect of the pits still in operation must be considered by the Committee; the ruthenium which is in the system must be removed. It is very advantageous that the current waste effluents contain very little ruthenium.

Recommendations:

The exact mechanism whereby the strontium and other isotopes have moved so rapidly to nearby wells and seeps is not understood, although several possibilities have been considered. The Operations Division plans to continue their investigation in hopes of salvaging some use of the trench. Meanwhile, no more radioactive liquid is being dumped into the trench.

The choice of location of Trench No. 6 appears to be unfortunate in that it is so near to ground water. It may even be that during the rainy season the level of ground water may be above the bottom of the trench, even if no liquid is pumped into the trench. Thus, even after the trench is abandoned there will be continued leaching of the radioactivity absorbed on the soil.

The amount of radioactivity that has been dumped into Trench No. 6 is relatively small (some 100 curies of strontium) and does not appear to be a serious hazard. However, if plans should develop to put some waste into this trench, the Committee would like to review such plans before they are executed. The Committee endorses Operations' plan to add caustic to Trench No. 6 and recommends that all waste be treated with caustic before being dumped into any pit. This should help tie up the radionuclides in the soil.

Submitted by W H Jordan for
Francois Kertesz, Executive Secretary
Laboratory Director's Review Committees

October 25, 1961

FK:bMcH

Attachments: 2

TX-2705 (1-61)

LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents
Meeting Date: October 17, 1961
Subject: Problems Presented by Leakage from Trench No. 6

Distribution:
T. A. Arehart
W. A. Arnold
S. E. Beall
F. T. Binford
K. B. Brown
F. R. Bruce
G. C. Cain
T. F. Connolly
J. A. Cox
G. A. Cristy
W. DeLaguna
J. C. Hart (4)
C. E. Haynes
T. W. Hungerford
D. G. Jacobs
R. G. Jenness
W. H. Jordan
F. Kertesz
E. Lamb
L. C. Lasher
M. L. Nelson
S. J. Rimshaw
A. F. Rupp
E. G. Struxness
A. M. Weinberg-J. A. Swartout
C. E. Winters
E. J. Witkowski

Waste Effluents - 1

UCN-2383
(3 11-60)

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation
UCC
Post Office Box X
Oak Ridge, Tennessee

For Internal Use Only

ORNL
CENTRAL FILES NUMBER
62-10-27

COPY NO. 19

DATE: October 9, 1962

SUBJECT: Minutes of Waste Effluents Committee Meeting, June 25, 1962

TO: Listed Distribution

FROM: Francois Kertesz

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report. The information is not to be abstracted, reprinted or otherwise given public dissemination without the approval of the ORNL patent branch, Legal and Information Control Department.

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: June 25, 1962 **Code Number:**

Present:

Members	**Experimenters or Operators**
R. N. Lyon, Chairman	
W. A. Arnold	
K. B. Brown	
G. C. Cain	
F. Kertesz	

Proposed Program for 1962

Using the report of W. H. Jordan, previous Chairman of the Committee, as a basis for the discussion the waste disposal problems facing the Laboratory were reviewed. The Committee will attempt to identify problems before an emergency arises.

It was agreed to consider among others the following questions: the HRT pond; the situation of the Gunite tanks; the possible increase of the treatment plant capacity and the problem presented by the trenches. In addition, the question of chemical contamination by materials such as chromates has been referred to although it is not strictly a radioactive waste disposal problem. Some concern was expressed on the limited storage capacity available for high-level waste. The recurrent problem of the high rate of using up land for disposal of solid radioactive waste has also been proposed as a subject for review.

It was decided that the problems involved in the location of the new trench will be discussed at the next meeting. This will be followed by the survey of the present status and the long range plans of liquid waste disposal.

Submitted by Francois Kertesz

Francois Kertesz
Executive Secretary

FK:bMcH

Committee: Waste Effluents Committee
Meeting Date: June 25, 1962
Subject: Proposed Program for 1962

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. K. B. Brown
6. F. R. Bruce
7. G. C. Cain
8. J. A. Cox

9-12. D. M. Davis

13. C. E. Haynes
14. T. W. Hungerford

15-16. F. Kertesz

17. R. N. Lyon
18. E. G. Struxness
19. A. M. Weinberg-
    J. A. Swartout
20. C. J. Whitmire
21. E. J. Witkowski
22. Laboratory Records - RC

UCN-2383
(3 11-60)

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation
UCC
Post Office Box X
Oak Ridge, Tennessee

For Internal Use Only

ORNL
CENTRAL FILES NUMBER
62-10-31

COPY NO. 22

DATE: October 9, 1962

SUBJECT: Waste Effluents Committee Minutes of Meeting Held July 9, 1962

TO: Listed Distribution

FROM: Francois Kertesz

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report. The information is not to be abstracted, reprinted or otherwise given public dissemination without the approval of the ORNL patent branch, Legal and Information Control Department.

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: July 9, 1962 **Code Number:**

Present:

Members	Experimenters or Operators
R. N. Lyon, Chairman	T. A. Arehart
W. A. Arnold	F. N. Browder
K. B. Brown	E. J. Witkowski
D. Phillips (substitute)	
W. DeLaguna	

Review of the Liquid Waste Disposal System at ORNL

Witkowski presented a short description of the current waste disposal system. The intermediate-level system involves between 7 and 10,000 gallons/liter of waste liquids which flow by gravity to a monitoring tank where they are neutralized. Most of these materials come from hot drains and similarly relatively high-activity areas. The liquid is collected in concrete surge tanks from which it goes into underground cast iron tanks, reaching ultimately the open pits or the covered seepage trenches. After seeping through the soil, the ruthenium contained in the liquid passes into the creek while the strontium is retained in the ground.

Two open pits are currently in use; the third one has been filled and covered up. It is planned to dig a second trench to supplement the first one which showed undesirable leakage. On the basis of present experience, the remaining pits probably will be filled by fall.

The process waste system has a capacity of about 500,000 gallons/day. A portion of this volume passes through the treatment plant but at times, especially on weekends, almost the whole amount bypasses the plant. Monitoring instruments have been installed in the manholes telemetering the information to a central location. An automatic diversion system is also in existence but for the last year and half nothing was diverted directly to the creek. The large volume of this process waste was due mostly to a certain lack of care in operation and to improper piping but the absence of a storm sewer at the south end of Building 4500 was a strong contributing factor. As a result of this situation, during the month of May the flow from the 4500 area decreased only by 40% over the weekend when most of the activity ceases. It is estimated that about one-third of the total process waste comes from the 4500 complex. On the other hand, Building 4500 is equipped with a storm sewer and the furnace water may be diverted directly to it.

As a result of these rather easygoing practices many water systems in the individual laboratories are never turned off. Unfortunately, the Operations Division does not have enough personnel to contact the persons involved. A contact man should be designated in each area to check the water consumption. The situation is under control now but if a new aqueous processing facility will be installed in Building 3019 the current waste disposal facilities will definitely be inadequate. For this reason, a bigger and different plant is planned.

At present the amount of total activity disposed is reduced to about 0.9 curies/month of strontium, most of which originates from the Graphite Reactor's storage canal. The previous chief culprit, the Metal Recovery Canal, has been shut down. Plans have been made to provide the Graphite Reactor canal with an ion exchange system.

Instead of simply increasing the capacity of the treatment plant, it would be preferable to cut down the water consumption. If a larger and better treatment plant is provided, it is quite possible that users will take advantage of the increased capacity and will relax their own vigilance; the waste effluents should be cleaned at their source. Operations at the Melton Valley depend greatly on improved practices of the users.

At present all the attention is focused on educating the research personnel not to pour radioactive waste in the ordinary sinks; at the same time an appeal should be made to them to cut down the water consumption. This could be achieved by organizing a cooperative effort of the divisional supervisors and administrators requesting them to remind the research personnel periodically. The efficiency of a concerted effort was proved by the remarkable reduction of the activity from 1 curie/day to 1 curie/month.

It is thus hoped that the Laboratory's goal concerning the disposal - not to depend on dilution in White Oak Creek and in the Clinch River for staying below the maximum permissible level - will be reached within the near future. Even though otherwise satisfactory, the present level of the activity discharged is ten times higher than that goal. Half of this amount originates from the pits and cannot be eliminated until the pits are removed from operation.

The creek monitoring system has been considerably improved; however, a sampling station and radiation monitoring instruments are needed at the upper portion of the system in order to establish the origin of the material released. Seepage from the solid waste burial ground may be detected by the monitor installed; no problem is encountered at present. The former HRT area does not present any trouble either. It should be mentioned, however, that data from the monitors on the ruthenium from the three waste pits do not balance with findings at the dam: although 600 curies of ruthenium are discharged, only 20 curies are found at the dam.

He urged that the Committee request operators of the individual facilities to reduce the activity <u>and</u> the volume of their process waste.

Browder reviewed the basic design of the liquid waste operation, emphasizing that his criticism is directed toward the system itself and not to the management of the waste removal operations. In opposition to the position taken by Witkowski he felt that a plant with a capacity of 750,000 gallons/day is definitely needed. Recirculation of the water has been considered in the past; the residue from recirculation passed through the demineralizer would be sent to the hot waste system. However, calculations made for the pilot plants in Building 3019 indicated that it is too expensive and would require considerable new piping.

The major difficulty at present is due to the overloading of the waste pits and trenches; correction of this situation would absorb a large portion of the $1.7 million appropriated for liquid waste disposal. The pits and trenches must be allowed to dry up. They are good in principle but they have been pushed too hard in the past. According to present plans, evaporators would be used for intermediate-level waste while the high-level liquids would be sent to storage tanks. The evaporator would reduce the volume by a factor of 10.

As mentioned previously, the amount of activity disposed lately remained fairly constant between 1 and 2 curies/month; for the 10 years ending in 1959 over 400 curies/year were disposed. The present situation is acceptable but it should be further improved. The MPC_w in the river was not exceeded in any quarter but during certain weeks in 1959 much higher amounts were released for short periods. It is also a fact that the Tennessee River has the highest activity of any major river in the United States; 80% of this activity is due to release from ORNL, the rest to weapons tests. The proposed large treatment plant would be a great step forward to remedy the situation.

The Laboratory's proposed new liquid waste system would include cooled storage tanks, currently being designed by the Engineering and Mechanical Division; construction is expected to start next year. It is planned to continue to use Tank No. W-5 whence the liquids will be sent to a feed tank or a distribution tank depending on the situation; the bottoms would be sent to Tanks No. W-6, W-7 or W-8. The total capacity of this tank system is 450,000 gallons.

The emergency impoundment basin is already in existence although it does not operate automatically yet. Detailed operational procedure will be prepared.

Some time ago it was proposed to build a bypass for the liquid waste at the dam providing a direct access from White Oak Creek to the river but no authorization was obtained for this work. The bypass would have left the lake behind the dam; the water of the lake cannot be absorbed as it is already at the level of the water table. Construction of such a bypass around the dam still appears to be desirable, keeping in mind that the dam itself consists of a simple earth fill.

In Melton Valley, the HRT contributed substantially to the activity in the creek but no numerical monitoring data are available to substantiate this. There is a discrepancy in the amount of strontium-90 released; a larger amount passed through the dam than could be accounted for on the basis of the release from the Laboratory. The new installations, such as the HFIR and the TRU Facility require a new collection system, the construction of which is due to start in the near future. A central waste station will be provided for the intermediate-level waste, to be kept under the control of the Operations Division.

The low-level waste in Melton Valley will be sent to special ponds providing a separate pond for each facility. The HFIR will have two ponds; one of them with valving which would also serve the TRU and the uranium-233 emergency containment system. The ponds will have two compartments to ensure that the liquids will not be discharged until their activity is determined.

Recirculation does not represent the final solution of the Laboratory's waste problems. Methods based on evaporation will not be in actual operation within the next two years. It should be remembered that the low-level waste system is not included in the budget.

Recommendations:

1. The Laboratory Facilities Department of the Operations Division (E. J. Witkowski) is requested to prepare a list of waste effluent problems at the Laboratory from the viewpoint of operations without necessarily considering the financial aspects. The Committee is interested in obtaining a compilation of the Laboratory's experts concerning the best possible system.

2. As a general rule, steps should be taken to ensure that the source of the liquid waste streams are known.

3. The users of the waste system are requested to take positive steps to reduce the volume of liquid waste they release to the system.

4. The Chemical Technology Division (F. N. Browder) is requested to supply estimates on the increase of the Melton Valley process waste after all the new facilities are in operation.

Submitted by Francois Kertesz
Francois Kertesz
Executive Secretary

FK:bMcH

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. F. N. Browder
6. K. B. Brown
7. F. R. Bruce
8. G. C. Cain
9. J. A. Cox

10-13. D. M. Davis

14. W. DeLaguna
15. C. E. Haynes
16. T. W. Hungerford

17-18. F. Kertesz

19. R. N. Lyon
20. D. Phillips
21. E. G. Struxness
22. A. M. Weinberg-
    J. A. Swartout
23. C. J. Whitmire
24. E. J. Witkowski
25. Laboratory Records - RC

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

October 18, 1962

To: Listed Distribution

I am attaching a corrected version of page 2 of the Waste Effluents Committee Meeting of July 9, 1962 (ORNL-CF-62-10-31). Please make the necessary change in your copy.

Francois Kertesz

Francois Kertesz
Executive Secretary

FK:bMcH

Distribution:
1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. F. N. Browder
6. K. B. Brown
7. F. R. Bruce
8. G. C. Cain
9. J. A. Cox
10-13. D. M. Davis
14. W. DeLaguna
15. C. E. Haynes
16. T. W. Hungerford
17-18. F. Kertesz
19. R. N. Lyon
20. D. Phillips
21. E. G. Struxness
22. A. M. Weinberg-
J. A. Swartout
23. C. J. Whitmire
24. E. J. Witkowski
25. Laboratory Records - RC

UCN-430
(3 5-61)

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: July 9, 1962 **Code Number:**

Present:

Members	Experimenters or Operators
R. N. Lyon, Chairman	T. A. Arehart
W. A. Arnold	F. N. Browder
K. B. Brown	E. J. Witkowski
D. Phillips (substitute)	
W. DeLaguna	

Review of the Liquid Waste Disposal System at ORNL

Witkowski presented a short description of the current waste disposal system. The intermediate-level system involves between 7 and 10 thousand gallons/day of waste liquids which flow by gravity to a stainless steel monitoring tank where they are neutralized, flowing then to underground concrete tanks and reaching ultimately the open pits or the covered seepage trenches. Most of these liquids come from hot drains and similar relatively high-activity areas. After seeping through the soil, the ruthenium contained in the liquid passes into the creek while the strontium is retained in the ground.

Two open pits are currently in use; the third one has been filled and covered up. It is planned to dig a third trench to replace the second one which was found to be leaking. On the basis of the present experience, it is hoped that the remaining pits can be filled by fall.

The process waste system has a capacity of about 500,000 gallons/day. For the past several months the plant has been operating at peak capacity and any future increase in volume will have to bypass the plant to be discharged directly into the creek. Monitoring instruments have been installed in the manholes telemetering the information to a central location. An automatic diversion system is also in existence but for the last year and half nothing was diverted directly to the creek. The large volume of this process waste was due mostly to a certain lack of care in operation and to improper piping but the absence of a storm sewer at the south end of Building 4500 was a strong contributing factor. As a result of this situation, during the month of May the flow from the 4500 area decreased only by 40% over the weekend when most of the activity ceases. It is estimated that about one-third of the total process waste comes from the 4500 complex. On the other hand, Building 4508 is equipped with a storm sewer and the furnace water may be diverted directly to it.

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation

Post Office Box X
Oak Ridge, Tennessee

Distribution Limited to
Recipients Indicated
For Internal Use Only

ORNL
CENTRAL FILES NUMBER
63-2-32

COPY NO. 18

DATE: February 18, 1963

SUBJECT: Waste Effluents Committee Minutes of Meeting Held October 15, 1962

TO: Listed Distribution

FROM: Francois Kertesz

"Use of this Report is Limited to Recipients Only unless the Author's Permission is Obtained"

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report. The information is not to be abstracted, reprinted or otherwise given public dissemination without the approval of the ORNL patent branch, Legal and Information Control Department.

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: October 15, 1962 **Code Number:**

Present: **Members** **Experimenters or Operators**

R. N. Lyon, Chairman
F. Kertesz
T. A. Arehart

In view of the absence of a quorum of the Committee the subject will be discussed again at the next meeting.

Disposal of Nonaqueous Solvents

Arehart reviewed the problems involved in the disposal of nonaqueous radioactive solvents which present problems at various areas of the Laboratory, in particular the pilot plant scale operations of the Chemical Technology Division. The Radiation Safety and Control Department was requested to approve the dumping of such solvents into the plant hot waste system but unfortunately no permission could be granted. The currently used procedure involves pouring the radioactive organic liquid into drums and sending it to the burial ground for disposal. The quantity contemplated at present by the Chemical Technology Division amounts to about 1000 gal/yr, with an activity of 30 curies per gallon. The problem is less serious in other divisions because the volume of the radioactive solvents released to the waste is quite low.

The Health Physics Division which was requested to express an opinion concerning the effect of the solvents on the Solid Waste Burial Ground, indicated that the solvents act as complexing agents and do not transfer the radioactive material to the shale. The latter acts as an ion exchange agent, removing strontium and cesium from aqueous solutions but probably does not exchange with activity in organics. Fortunately, the radioactive material is mostly short-lived.

The problem is complicated by the fact that some portions of a solvent may be strongly radioactive while the rest may be "cold;" if the drums contain radioactive materials, they must be shielded and handled by special apparatus such as shielded trucks. Therefore, it is estimated that the complete facility for Building 4507 including special carriers and apparatus for the transfer of the liquids from the container, transportation of the carrier to the burial ground, and ultimate disposal of the solvent would require at least $25,000. In addition, the Isotopes Division probably will have similar problems requiring the safe disposal of 2000 gal/yr of contaminated organic solvents, probably necessitating about $50,000 during the first year.

In most cases the actual disposal does not involve burying the drum but releasing the liquid into a crushed-rock-filled seepage trench prepared specifically for this purpose.

The use of large mobile cranes needed for removing the drums from the carriers would be also quite expensive; added expenses are caused by the usually acid character of the solutions which eliminates iron drums, necessitating the use of stainless steel ones.

In view of the above, it appears best to allow the operators to send their contaminated organic solvents to their monitoring tanks. Before that can be permitted, the tanks must be vented to off-gas and provided with a flame arrestor and with suitable instrumentation to ensure that the concentration of the organic stays below the explosive limit. As the tanks are underground, dissipation of heat does not present special problems. Of course, the organic liquids still must be disposed in some manner at some future time, but at least they would be conveniently concentrated in one spot.

Another solution would consist in sending the aqueous phase to a flash evaporator and disposing of the organic phase by means of an incinerator. The Engineering and Mechanical Division is studying this problem and will soon submit a cost estimate based on the combustion of contaminated solvents equivalent to 75 gallon of kerosene per day. The carbonized organic solvent would stay in the container which then would be disconnected from the system and buried separately. Thus, the container will not be part of the system but would be simply placed within a heating unit and could be easily removed from it. It should be noted that the total solids concentration in the organic solution is usually very small.

At the present time a study is being made to determine if non-radioactive solvents could be discharged through the process drain. The possibility of fires in the drain line and the effects of solvents on the proposed process waste ion exchange system must be considered.

The whole solvent waste disposal problem is complicated by the fact that the ORNL waste system was conceived and constructed to handle processes and programs involving only aqueous wastes, such as the Bismuth-Phosphate Process. Very few changes have been made to the system in the past 20 years, even though the current processes and programs require considerable quantities of various types of solvents.

Discussion of this subject will continue.

Another system involves burning the organic phase without an elaborate filtering system and would incorporate a flue gas scrubber and roughing filters. The scrubber would be large and efficient enough to cool and remove the bulk of the particulate matter from the flue gas. Use of the scrubber introduces the problem of disposing of the water. At first view, this system appears to be more expensive; its potential use will depend on the evaluation of all the factors.

Present experience indicates that drumming and burying of radioactive organic waste solvents is not a satisfactory method because of the leaking, burning and explosion hazards involved in moving the drums from the operation site to the burial ground for unloading.

The problem arises whether permission be given to dump solvents into the various aqueous drains. At present, chemists are allowed to dump very small amounts of alcohol, acetone and similar water-missible solvents, but enough water must be added simultaneously to adequately dilute the solvent; large quantities must be bottled or drummed for burial ground disposal.

Documents Submitted:

1. Memorandum by F. R. Bruce to Distribution, "Disposal of Flammable Solvents" dated September 14, 1962.

2. Memorandum by J. H. Gillette to T. A. Arehart, "Disposal of Flammable Solvents" dated October 5, 1962.

Submitted by Francois Kertesz
Francois Kertesz
Executive Secretary

FK:wc

Committee: Waste Effluents Committee
Meeting Date: October 15, 1962
Subject: Disposal of Nonaqueous Solvents

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. K. B. Brown
6. F. R. Bruce
7. G. C. Cain
8. J. A. Cox

9-12. D. M. Davis
13. T. W. Hungerford
14-15. F. Kertesz
16. R. N. Lyon
17. E. G. Struxness
18. W. M. Weinberg-
J. A. Swartout
19. C. J. Whitmire
20. E. J. Witkowski
21-22. Central Research Library
23. Y-12 Document Reference Section
24. Laboratory Records - RC

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation

Post Office Box X
Oak Ridge, Tennessee

Distribution Limited to Recipients Indicated For Internal Use Only

ORNL CENTRAL FILES NUMBER

63-2-33

COPY NO. 19

DATE: February 18, 1963

SUBJECT: Waste Effluents Committee Minutes of Meeting Held October 22, 1962

TO: Listed Distribution

FROM: Francois Kertesz

"Use of this Report is Limited to Recipients Only unless the Author's Permission is Obtained"

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report. The information is not to be abstracted, reprinted or otherwise given public dissemination without the approval of the ORNL patent branch, Legal and Information Control Department.

OAK RIDGE NATIONAL LABORATORY

LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: October 22, 1962 **Code Number:**

Present: **Members** **Experimenters or Operators**

R. N. Lyon, Chairman
W. A. Arnold
G. C. Cain
F. L. Parker
F. Kertesz
T. A. Arehart

Chairman Lyon and Arehart continued the discussion of the problem presented by the radioactive organic process waste. The Chemical Technology Division must dispose of about 2000 gallons per year of contaminated organic solvents the activity of which reaches 30 curies/gallon, and requested permission to send the material to the intermediate waste system; the Isotopes Division might have to dispose of more than twice that amount. In order to ensure that all the radioactive organic waste is sent to this system it would be desirable to have an organic drain in every laboratory; unfortunately, this is not feasible at present. The available 2-in. line is too small. In view of the danger presented, this organic solvent stream is sent to Tank W-5. Since then some concern was expressed that an excessive amount of the organic material might accumulate in the tank resulting in the formation of an explosive mixture in the gas phase.

The situation might be eased by 1964 when the Melton Valley waste system will be ready. The evaporator could be put into service at the same time. According to present plans, the waste to be evaporated will be pumped from Melton Valley to Bethel Valley, sending the condensate to the process waste system and the concentrate to the high-level tanks. Up to now, only an intermediate-level waste could be handled and therefore many programs had to be rejected because the Laboratory was unable to dispose of the high level waste. The same evaporators could take care of the organic material. The current situation represents only a temporary solution because eventually the concrete tanks will be completely filled with sludge.

Disposal of the intermediate waste at the burial ground is acceptable for the 2000 gallons originating from the Chemical Technology Division; the method is considered to be too expensive for amounts twice that large from the Isotopes Division but it must be used until an alternate solution is found. It is proposed to send the organic liquids first to a monitoring tank then to the W-5 Tank, providing the former with a breather containing a filter head. Thus, in case of a fire in the tank, the contaminated gases and fumes would be safely contained. As the main line originates from a contained facility, the backed-up smoke would still be contained. The off-gas line connected to the monitoring tank is scrubbed and filtered and thus does not present a hazard. The smoke and fumes would go in this direction because the off-gas line is always under reduced pressure. Use of the breather is necessary because the monitoring tank will be alternately filled and emptied during the regular operation and thus the gas will be released under controlled conditions. It is proposed to move the liquid to the tank by means of a pump installed in the line.

The possibility of the formation of an explosive mixture in the gas phase of the large concrete tank must be taken into account. Dumping small amounts of alcohol, acetone and other hydrophilic solvents into the process drains is permissible as long as the amounts do not become too large. Use of nitrogen blanket in the tank and installation of a burning system for the organic liquids appears to be a desirable solution to this problem. In addition, it is also planned to cover the gauging hole on the large concrete tank with a filter and a flame arrester. The use of CO_2 as a blanket gas has been proposed but this is not feasible because the CO_2 is soluble in the caustic solution needed to neutralize the acid stream. The cost of the nitrogen blanket would not be excessive. The main problem is presented by the high level.

When these improvements are completed, the tank system will be acceptable from the viewpoint of the containment of radioactive smoke in case of fire.

Turning to the disposal of the process waste, it is considered to be under control, although its volume and level should be further reduced. The main source of strontium is not the current process waste released in the White Oak Creek. The treatment plant reaches its ultimate capacity except for operations during the night and on weekends. It is planned to build a new pond for the 4500 South Building where many large contributors are located; most of this waste could be released directly because in many cases it is not contaminated. The actual construction cost of the pond itself is relatively low; laying the necessary pipelines requires the major portion of the expenses.

Parker mentioned that other methods, such as the hydrofractionation currently under study at the Health Physics Division, might be a satisfactory alternative to pot calcination. The Waste Disposal Group of that Division collaborates closely with Engineering and Mechanical Division on a flume test. This involves mocking up the conditions which take place in the river by means of a scaled trough for determining the parameters of a release from the Melton Dam. Under certain conditions the Laboratory might discharge directly into the lake rather than into the creek. Construction of a new gauging and sampling station is highly desirable for a better understanding of the situation.

It was agreed that the Committee will review the research on liquid waste disposal carried out in the Health Physics Division.

Committee: Waste Effluents Committee
Meeting Date: October 22, 1962
Subject:

Lyon agreed to prepare recommendations for handling the process waste on the basis of the discussions held up to date. This draft will be circulated to Committee members for comments.

Submitted by Francois Kertesz
Francois Kertesz
Executive Secretary

FK:wc

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. K. B. Brown
6. F. R. Bruce
7. G. C. Cain
8. J. A. Cox

9-12. D. M. Davis

13. T. W. Hungerford

14-15. F. Kertesz

16. R. N. Lyon
17. F. L. Parker
18. E. G. Struxness
19. W. M. Weinberg-
    J. A. Swartout
20. C. J. Whitmire
21. E. J. Witkowski

22-23. Central Research Library

24. Y-12 Document Reference Section
25. Laboratory Records - RC

~~XAS~~ Suby

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation

Post Office Box X
Oak Ridge, Tennessee

Distribution Limited
To Recipients Only
For Internal Use Only

ORNL
CENTRAL FILES NUMBER
63-2-50

DATE: February 19, 1963

COPY NO. 19

SUBJECT: Waste Effluents Committee Minutes of Meeting Held October 29, 1962

TO: Listed Distribution

FROM: Francois Kertesz

USE OF THIS REPORT IS LIMITED TO RECIPIENTS ONLY UNLESS THE AUTHOR'S PERMISSION IS OBTAINED.

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report. The information is not to be abstracted, reprinted or otherwise given public dissemination without the approval of the ORNL patent branch, Legal and Information Control Department.

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: October 29, 1962 **Code Number:**

Present: **Members** **Experimenters or Operators**

R. N. Lyon, Chairman
W. A. Arnold
G. C. Cain
F. Kertesz
E. G. Struxness

Chairman Lyon presented 3 charts* which he prepared on the basis of the liquid radioactive waste disposal reports for June, July and August, having recalculated them on activity per million gallons basis. The charts identify the sources of the process wastes, indicating where they approach or exceed the permissible level on the basis of the MPC value for the 40-hr exposure per week, corresponding to 15 mc/million gallons. The chart pinpoints the location from which most of the volume is released, together with the activity level. Only 33-36% of the water released exceeded the maximum permissible criteria during July and August but about 70% of the stream exceeded it during the month of June. It is of interest to note that during June the Isotopes Division released 0.2 MPC, while in July the value reached 30 MPC's. The activity dropped back considerably during August, but it was still above the MPC level (1.8 MPC). The high July value is due to the operation at the FPDL. The reactors in general are not large contributors.

Struxness pointed out that the 40-hr limit is not realistic; it is too stringent, and the values should be multiplied by 4. The White Oak Dam is considered as the last point of control by the Laboratory and the limiting value is set at 4×10^{-7} curies, determining the other values backward from this point. The level of Sr-90 is down to 1 micro-microcurie per liter, or, about one-tenth of the limit in the Tennessee River. As a general rule, the MPC values taken from the handbook should not be applied to the activity of the water in the creek because that water is not used for drinking. The MPC values are based on continuous exposure for a whole lifetime and they do not apply if this is not the case. This problem was discussed in great detail at the May 1962 dosimetry meeting in Stockholm.

Although radioactive waste streams from the reactors and processing buildings have been reduced, contributing to cleaning up of the river, other factors, outside the control of the Laboratory, contribute to the contamination. The most important source is the activity already in the creek

* Attached to this report.

which is released at a slow but uncontrolled rate. At present, no problems are encountered at the river itself: the discharges from the Laboratory are not considered unsafe, and the present practice could be followed indefinitely. In order to make the chart more meaningful, all sources should be represented in it, including the contribution from the burial ground, the waste pits and other sources.

In considering the problem of liquid radioactive waste disposal from ORNL the whole geographic situation should be taken into account. The following unfavorable factors may be listed:

1. The size of the Laboratory's drainage basin is only 6 square miles. The terrain consists of a few key points having a relatively high relief. The difference in altitude from the top of Melton Hill to the point entering the river is about 600 ft.

2. There is an abnormally high rainfall in the area.

3. In view of the fairly impermeable residuum, the rainfall runs off fairly rapidly instead of being absorbed into the ground.

4. The area consists of short and narrow earth columns and as a result of this the contaminated water is kept together while it moves.

Advantages of the system include the high absorptive capacity of the soil and of the sediments. In addition, the Laboratory is located in a saucer shaped area with relatively little leak. The flow of water represents the principal method for spreading activity from the area. A serious problem would arise if a large amount of contaminated water would be generated and released suddenly because the water would find its way very rapidly into the river. This problem should be carefully considered in the operation of the emergency basin: the large amount of anticipated rain water could probably cause an overflow of the contaminated release that might be stored there, causing it to reach the river in a relatively short time. In general, the now "discredited" pit system represents an excellent way to dispose of contaminated liquid because it avoids the direct run-off. The pits retain cesium and strontium and let through only relatively small amounts of the less dangerous ruthenium.

Recommendations

It was agreed that the Committee will limit its activities for the current year to a thorough consideration of liquid radioactive waste disposal problems. Before preparing the final report, experts will be invited to present a summary of the Clinch River study and to discuss the MPC and the ingested dose problems.

Submitted by Francois Kertesz
Francois Kertesz
Executive Secretary

FK:wc

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. K. B. Brown
6. F. R. Bruce
7. G. C. Cain
8. J. A. Cox

9-12. D. M. Davis

13. T. W. Hungerford

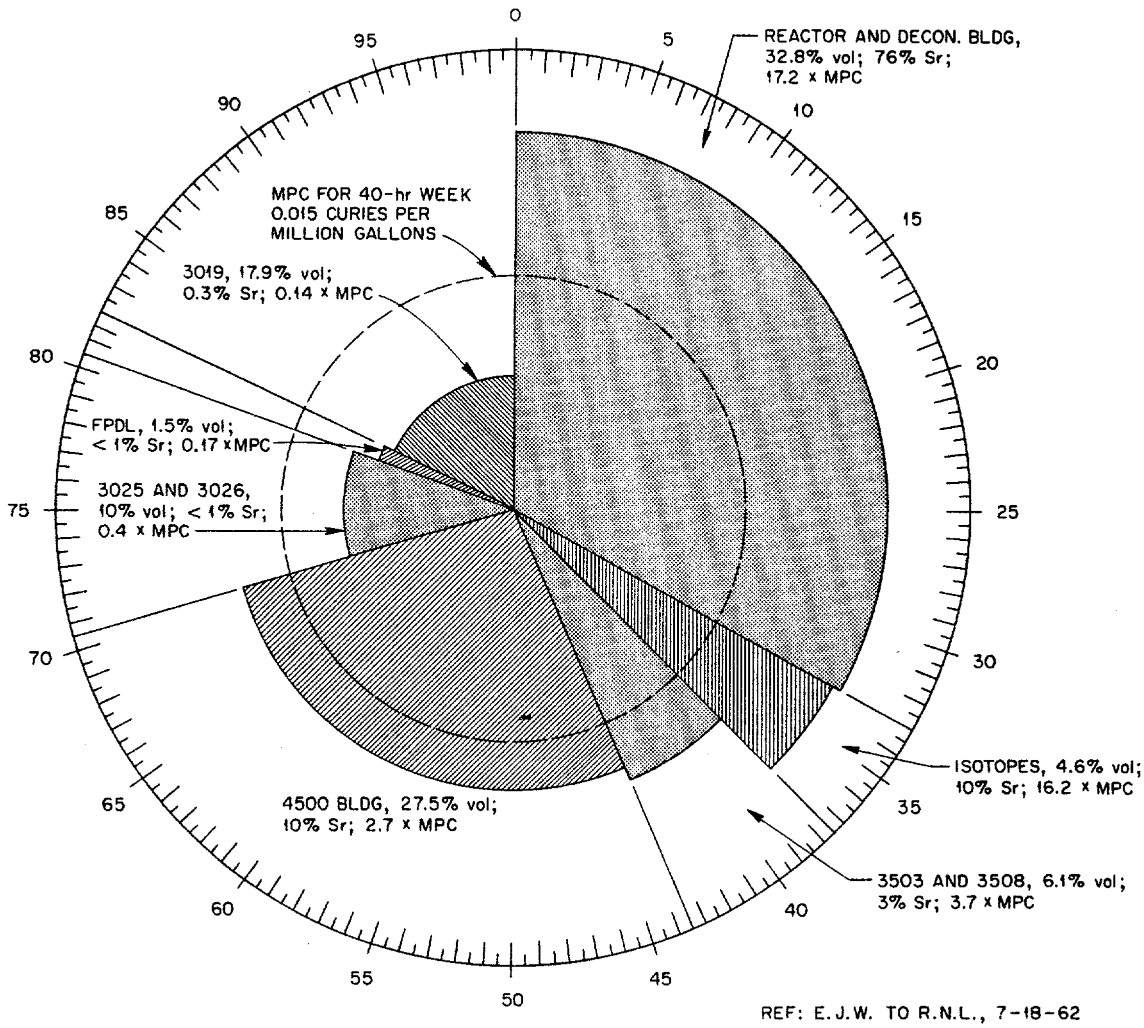
14-15. F. Kertesz

16. R. N. Lyon
17. F. L. Parker
18. E. G. Struxness
19. A. M. Weinberg-
J. A. Swartout
20. C. J. Whitmire
21. E. J. Witkowski

22-23. Central Research Library

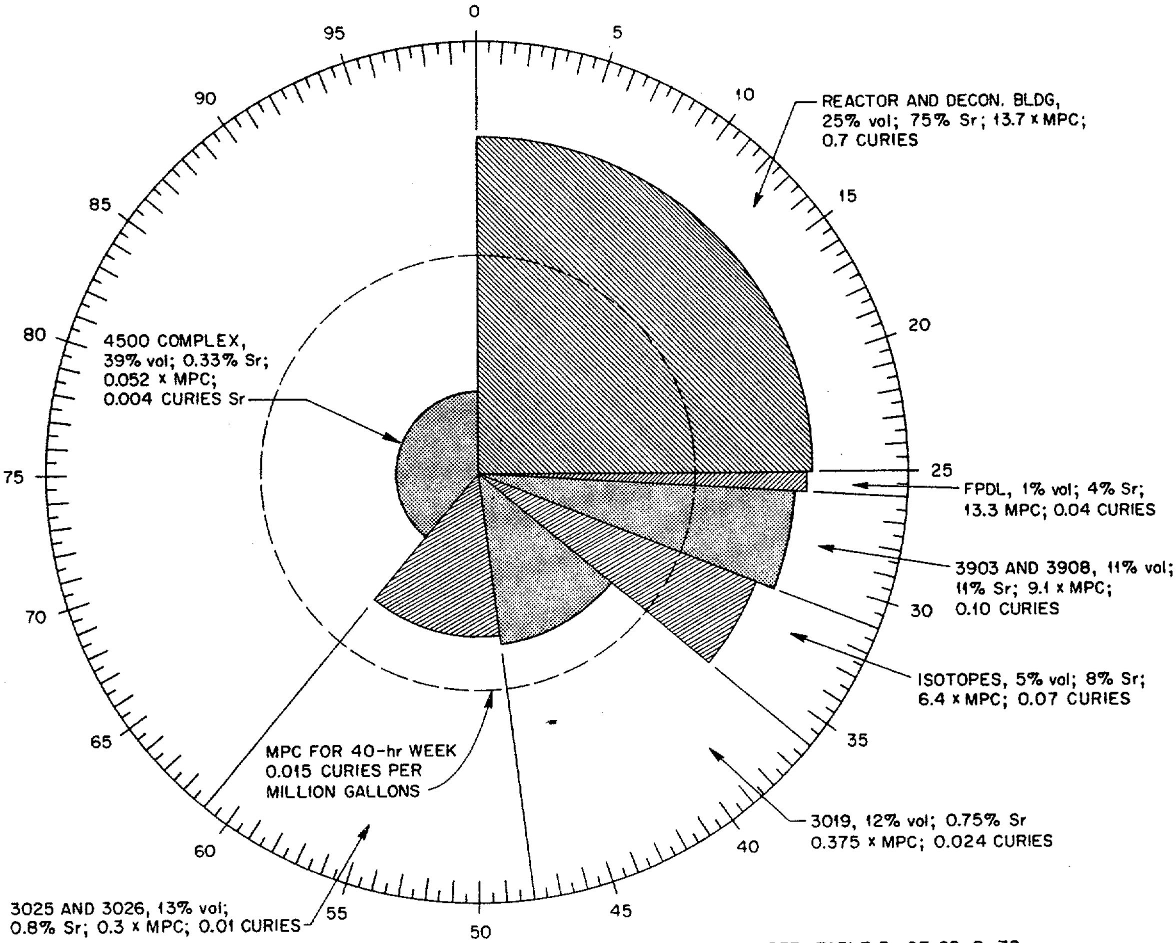
24. Y-12 Document Reference Section
25. Laboratory Records - RC

UNCLASSIFIED
ORNL-LR-DWG 75150



Process Waste: June, 1962

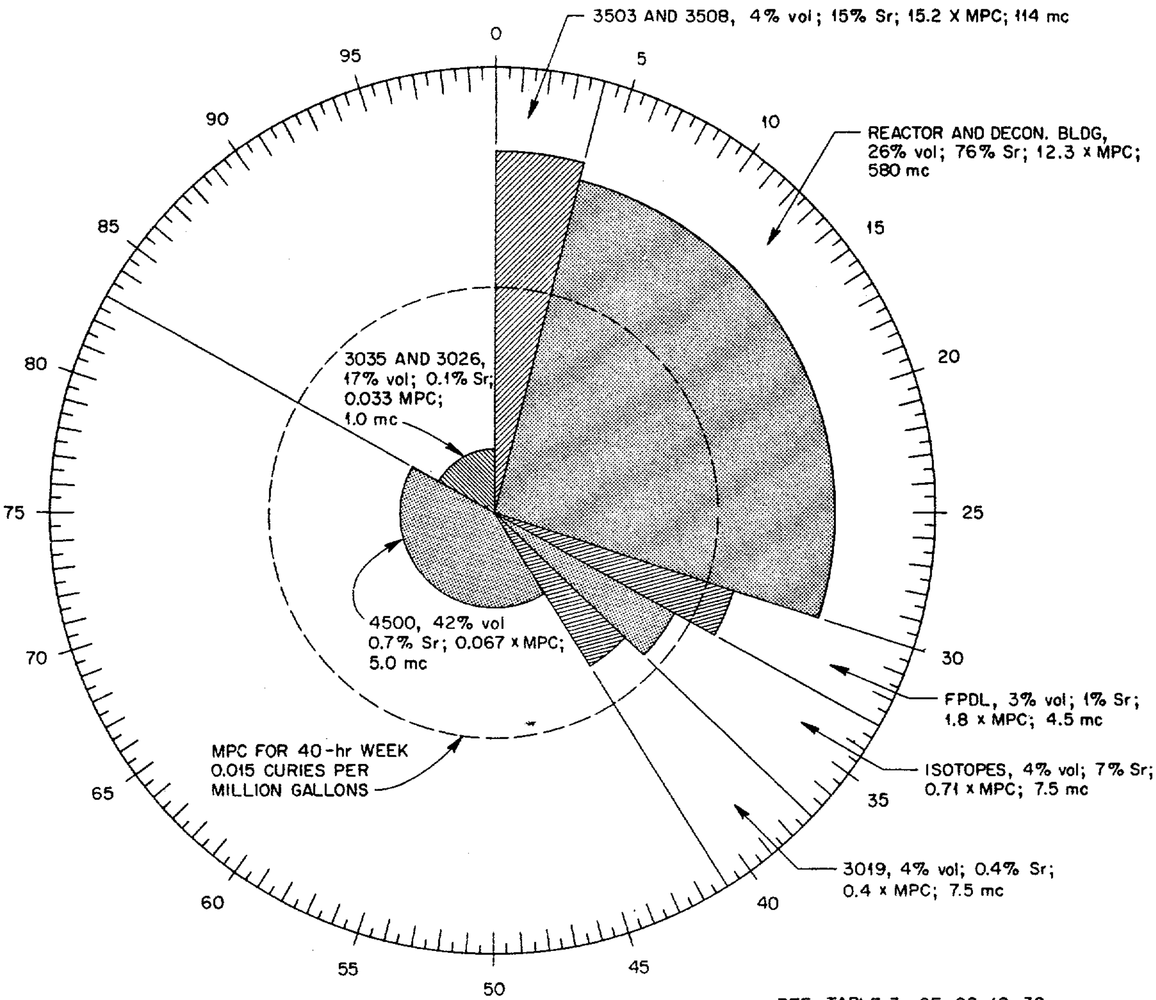
UNCLASSIFIED
ORNL-LR-DWG 75149



REF: TABLE 3, CF 62-8-72

Process Waste: July, 1962

UNCLASSIFIED
ORNL-LR-DWG 75148



REF: TABLE 3, CF 62-10-39

Process Waste: August, 1962

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation

Post Office Box X
Oak Ridge, Tennessee

Distribution Limited
To Recipients Indicated
For Internal Use Only

ORNL
CENTRAL FILES NUMBER
63-3-40

COPY NO. 22

DATE: March 21, 1963

SUBJECT: Waste Effluents Committee Minutes of Meeting Held November 12, 1962

TO: Listed Distribution

FROM: F. Kertesz

USE OF THIS REPORT IS LIMITED TO RECIPIENTS ONLY UNLESS THE AUTHOR'S PERMISSION IS OBTAINED.

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report. The information is not to be abstracted, reprinted or otherwise given public dissemination without the approval of the ORNL patent branch, Legal and Information Control Department.

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: November 12, 1962 **Code Number:**

Present:

Members	**Experimenters or Operators**
R. N. Lyon, Chairman	T. A. Arehart
W. A. Arnold	T. F. Lomenick
K. B. Brown	
G. C. Cain	
F. Kertesz	
E. G. Struxness	

Multiple Sources in the Drainage Basin Contributing to the Creek

Lomenick presented a review of our current knowledge on the accumulation and the movement of radionuclides in the White Oak Creek basin. This drainage basin receives waste streams from all ORNL facilities that contribute significant quantities of radionuclides to the environment. At present low-level waste water, most of which is pretreated, is released directly to surface streams, intermediate-level liquid waste is pumped to seepage pits, solid waste is buried in unlined earthen trenches, and gaseous waste, after treatment, is discharged to the atmosphere through tall stacks. There are more than 20 known sources of radioactive contamination in the drainage basin.* The creek receives directly the discharges of partially treated process waste water, laundry water, sanitary sewage and reactor retention pond effluents, and eventually seepage from seven intermediate level waste seepage pits and five solid waste burial grounds. Runoff from land surfaces which are subjected to local fallout from four tall stacks and to general fallout also contribute some activity to the creek. In addition, some radionuclides enter the creek from the beds of former White Oak Lake and Intermediate Pond.

Permanent water sampling stations now exist along White Oak Creek at White Oak Dam and at mile WOCM 1.8, on each of the two streams that drain the intermediate-level waste seepage pit area, on Melton Branch just upstream from its confluence with White Oak Creek and on the effluent from the Process Waste Water Treatment Plant. These stations, which employ proportional sampling devices and are operated by the Operations Division and the Applied Health Physics Section, provide information primarily on the amount and type of activity leaving the major contamination sources at ORNL and that discharged to the Clinch River. Three temporary water sampling stations were established on White Oak Creek and on the tributary stream that drains the northwest portion of the area.* These stations helped to determine the amount and type of activity contributed to the

---

* See Fig. 1.

system from fallout, burial ground, and other sources in Bethel Valley that could not be monitored directly. In addition, these stations have provided information on the chemical composition of the creek water, transport of sediments and volume of flow in the creek. Representative samples were also taken from the effluent originating from the laundry and the Sewage Treatment Plant and from a contaminated storm sewer that discharges into White Oak Creek just downstream from the PWWTP effluent in Bethel Valley.

The relatively high degree of contamination in White Oak Creek below the Process Waste Water Treatment Plant makes it difficult to detect small quantities of waste that may seep directly into the creek from Burial Ground 4, the beds of former White Oak Lake and the Intermediate Pond. A previous study of Burial Ground 4 has shown that radionuclides are leached from the buried waste and transported by ground water through the soil to points of discharge in or near the surface streams; however, the amount of activity that reaches White Oak Creek is negligible. Geologic and hydrologic studies in the beds of former White Oak Lake and the Intermediate Pond, although incomplete, indicate little movement of the radionuclides that are associated with sediments at these sources.

Battery-operated devices with rotating scoops that collect a sample once every 15 minutes were used as water sampling instruments at the creek stations and the Sewage Treatment Plant. The amount of sample taken is directly proportional to the flow over a weir or through a Parshall flume; by means of water-level recorders a continuous record of the discharge at each station was obtained.

Table 1 summarizes the radioactivity released to the creek from the various sources of contamination for the period of May to December, 1961. It is of interest to note that the Process Waste Water Treatment Plant is the largest single contributor of Sr-90 and Cs-137, but seepage from the waste pits accounts for practically all of the Co-60 and Ru-106 in the system.

During the 8-month long sampling period the Sewage Treatment Plant contributed approximately 197 millicuries of Sr-90 to the creek. While this is small in comparison with the amount released from the Process Waste Water Treatment Plant, it is large for a facility that should be free from contamination. The mean concentration of Sr-90 in the Sewage Treatment Plant effluent was 1.7×10^{-6} microcuries/cc or about 40% of MPC_w for 40 hr/wk occupational exposures.

About 3000 pounds of contaminated clothing are washed and decontaminated each week at the laundry. All wash water drains into a storm sewer, from which it is discharged into White Oak Creek. The amount of activity that is released from this facility is small.

Burial Ground 3 and the extreme northwest portion of the ORNL site are included in the drainage area of the northwest tributary stream. Approximately 34% of the White Oak Creek water shed is located above the sampling station at mile WOCM 2.6. Burial Ground 2 and the LITR and ORR retention ponds are within this area; on the other hand, there are no ORNL facilities or waste disposal areas in the drainage area of the sampling station located at White Oak Creek mile 3.9; thus, the activity detected at this station is the result of rainfall and surface runoff, which leaches and transports soils contaminated by Laboratory and general fallout, amounting to about 3 curies per square mile per year. Based on samples taken at this station, it is calculated that about 15 millicuries of Sr-90, or less than 0.5% of the total entering the creek during the eight months sample period, was due to fallout. Contamination detected at the other stream sampling stations is due to fallout, discharges or seepage from known sources within the drainage area and sources that are as yet unknown or undefined.

Relatively large amounts of Sr-90 were detected in the drainage from the storm sewer emptying into White Oak Creek below the PWWTP in Bethel Valley. The actual source of this activity is not known.

Until July 1961 the HRT routinely released liquids containing fission products to Melton Branch and gaseous wastes through a tall stack to the atmosphere. These past releases have contaminated the stream bed below the facility; leaching and scouring of the creek bed causes activity to continue to move from the area.

Currently, several thousand curies per year of ruthenium flow onto the bed of former White Oak Lake from the Laboratory's intermediate-level waste pits. As the waste water traverses the lake bed, a significant part of the ruthenium is removed from solution. The ruthenium that is not sorbed on the lake-bed soil drains into White Oak Creek, a tributary of the Clinch River.

An investigation was made to determine the quantity and distribution of ruthenium in the soil of the lake bed and to identify and define geohydrological factors affecting the movement of ruthenium through the lake bed. As of February 1962, the lake bed contained approximately 1200 curies of ruthenium. The ruthenium is present mainly in two tracts of contamination, covering approximately 10 acres, that coincide roughly with the surface flow of waste over the bed. The highest concentrations of ruthenium occur in the uppermost few inches of the lake bed, and about 70% of the activity is in the top 2 feet of soil.

The lake bed is underlain by a thin layer of recent lacustrine sediment, several feet of alluvium, and the Conasauga shale formation of Cambrian age. Water-level measurements indicate that the depth to ground water varies from less than 1 to 5 feet below the surface. The subsurface migration of ruthenium follows closely the paths indicated by water-table contours. The rate of ground water movement in the upper 2 feet of soil varies from 1 to 5 feet per day, while movement in the material 2 to 5 feet below the surface ranges from 0.05 to 0.25 feet per day. Thus, the maximum rate of travel of ruthenium in the upper layers of soil is approximately 20 times that of the lower layers.

Only a small fraction of the ruthenium that enters White Oak Creek from the lake bed is transported by ground water through the lake-bed soil into the creek. The ruthenium that is not sorbed moves at such a slow rate through the soil that radioactive decay reduces the concentration of that reaching the creek to insignificant proportions. The amount of surface flow and, consequently, the quantity of ruthenium that reaches the creek from the lake bed varies seasonally. During the dry summer months, drainage from the waste pits recharges the ground water in the lake bed, and, thus, there is little surface flow, and consequently, little ruthenium that flows into White Oak Creek. However, in the wet winter season surface runoff from the lake bed is high, and, therefore, larger amounts of ruthenium enter White Oak Creek.

A sampling train that separates suspended solids directly from creek water was used to study the transport of suspended solids and their associated activity in White Oak Creek. The unit consists of a strainer and four separate hydroclones which remove solids with median diameters of 29, 19, 12 and 9 microns. Eight operating runs, ranging from 1 hr to 4 hr duration, have been made in White Oak Creek at mile 1.8.

Tables 2 and 3 present a summary of the percentages of cesium and strontium in creek water associated with the liquid phase and with various particle-size ranges of suspended solids. The highest values of sorbed cesium and strontium occurred during the runs made when the suspended solid load and the stream flow were high. The maximum of sorbed strontium was approximately 25%, while as much as 96% of the cesium in the creek water was found to be associated with suspended solids in runs 7 and 8. This suggests that during low flow rates and/or low suspended solids loads, most of the Sr and Cs in White Oak Creek is associated with the liquid phase, but during high stream flows and/or heavy suspended solids loads, practically all of the cesium and a significant part of the strontium is transported downstream by suspended solids.

The tables also show that considerably more activity is associated with suspended solids less than 9 μ in size than with the larger particle sizes. For larger particles considerable variations were found in the amounts of activity associated with the various separated fractions. As a general rule the maximum concentrations for the larger size fractions were not associated with any particular particle size group.

Hazards Discussed and Safeguards Suggested

Is the present monitoring practice considered to be satisfactory?

In general, the monitoring equipment is satisfactory; however, the recently installed monitoring devices of the Operations Division do not supply all the desired information because they are not proportional to flow at high discharge rates. There is also some question as to the accuracy of the flow measurements taken in the streams emitting from the waste pits. E. J. Witkowski indicated recently that additional monitors are needed.

Is the contamination caused by fallout a serious factor?

Based on samples from a small part of the drainage basin, only about 1015 millicuries of strontium reached the creek from fallout during the eight months sample period; this is the same order of magnitude as the contamination caused by the laundry. It should be emphasized, however, that at these low levels exact measurements are very difficult.

What is the contribution of the storm sewers?

This problem requires further checking. The difficulty again lies in the fact that it is hard to detect strontium in small amounts.

It is noted that Station No. 1 is not on the creek but on an effluent of the settling basin. Is it possible that the settling and the equalization basins contribute to the ground water discharge?

Probably only very small amounts enter the creek by this means. A geological and hydrological survey, conducted about thirteen years ago, revealed that large solution cavities do not occur in the limestone formation that underlies the settling and equalization basins in Bethel Valley.

Could leaks between hot lines and sanitary sewers cause problems?

> The amounts found probably do not come from the sewage lines. On the other hand, it must be admitted that there are hot lines at various areas in the Laboratory which may leak and thus may cause some local contamination of the ground water. During the years many modifications were made in these pipes and the drawings are not completely up to date.

Could this problem be solved by repiping the Laboratory's drainage system?

> This would require an extremely high investment and cannot be seriously considered at this time for financial reasons.

How could the overall radioactive liquid waste disposal program of the Laboratory be improved?

> Probably nothing more can be done for reducing the released cobalt and ruthenium; on the other hand, it should be noted that strontium has been considerably reduced during the past few months.

What is the contribution from the burial grounds?

> This is hard to determine but is considered to be relatively small.

What is the efficiency of the disposal pits?

> About 95% of the ruthenium that reaches the pits stays there; a part of the remainder that reaches the White Oak Creek bed is also retained. The ruthenium output of the system is less than the input. The opposite has been observed with strontium, in which case more is coming out than is put in.

What is the anticipated contribution of the MSRE?

> This reactor experiment is not supposed to discharge any radioactive waste into the disposal system.

What plans have been made concerning the disposal of the radioactive wastes of the HFIR?

> The HFIR will have its own new waste system; several new ponds will be constructed and therefore it will be possible to release some activity. It should be remembered that these reactors are in a different drainage basin.

Have criteria been established for waste disposal pits and trenches?

It is attempted to place the pit or trench at the top of a gently sloping ridge. The liquid leaking out could flow to either side of the ridge.

What is the chief problem in the operation of the waste disposal system?

Infiltration or seepage into the pits lowers the pH from the usual value of 11 to 12. The normal pH of the liquid in contact with the shale is slightly on the acid side.

Pit No. 3 is in a slight depression and thus it collects water easily. The asphalt covering was not too successful and water may enter it from the sides and top. It is planned to improve the technique of covering when Pits 2 and 4 are to be filled in. The asphalt spray was not found satisfactory as sealing material.

How much activity is retained at present in the soil in the neighborhood of the Laboratory?

About 1/2 million curies are retained in the soil; it is very important to take steps that this activity remains there and is not leached out.

How is the sludge from the Process Waste Water Treatment Plant disposed of?

This material has been dumped into Waste Pits 2, 3 and 4. Also some has been disposed of in a special trench at the burial ground.

How does plant life affect the ground surface above the recently covered pits?

Grass on the surface makes the ground more permeable; therefore, an asphalt or other covering is imperative.

Could polyethylene sheets be used?

They would be acceptable but additional concrete or earth cover would still be required.

Would it be possible to bury a pipe in these areas, filling it with sodium carbonate solution?

This is not necessary if the waste remains suspended above the water table and infiltration of rainfall can be halted. The 65 wells, in existence in this area, should be preserved for future checking; they will be very useful for monitoring.

Submitted by Francois Kertesz
Francois Kertesz
Executive Secretary

FK:wc

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. K. B. Brown
6. W. E. Browning
7. F. R. Bruce
8. G. C. Cain
9. S. F. Carson
10. J. A. Cox

11-14. D. M. Davis

15. T. W. Hungerford

16-17. F. Kertesz

18. T. F. Lomenick
19. R. N. Lyon
20. F. L. Parker
21. E. G. Struxness
22. W. M. Weinberg-
    J. A. Swartout
23. C. J. Whitmire
24. E. J. Witkowski

25-26. Central Research Library

27. Y-12 Document Reference Section
28. Laboratory Records - RC

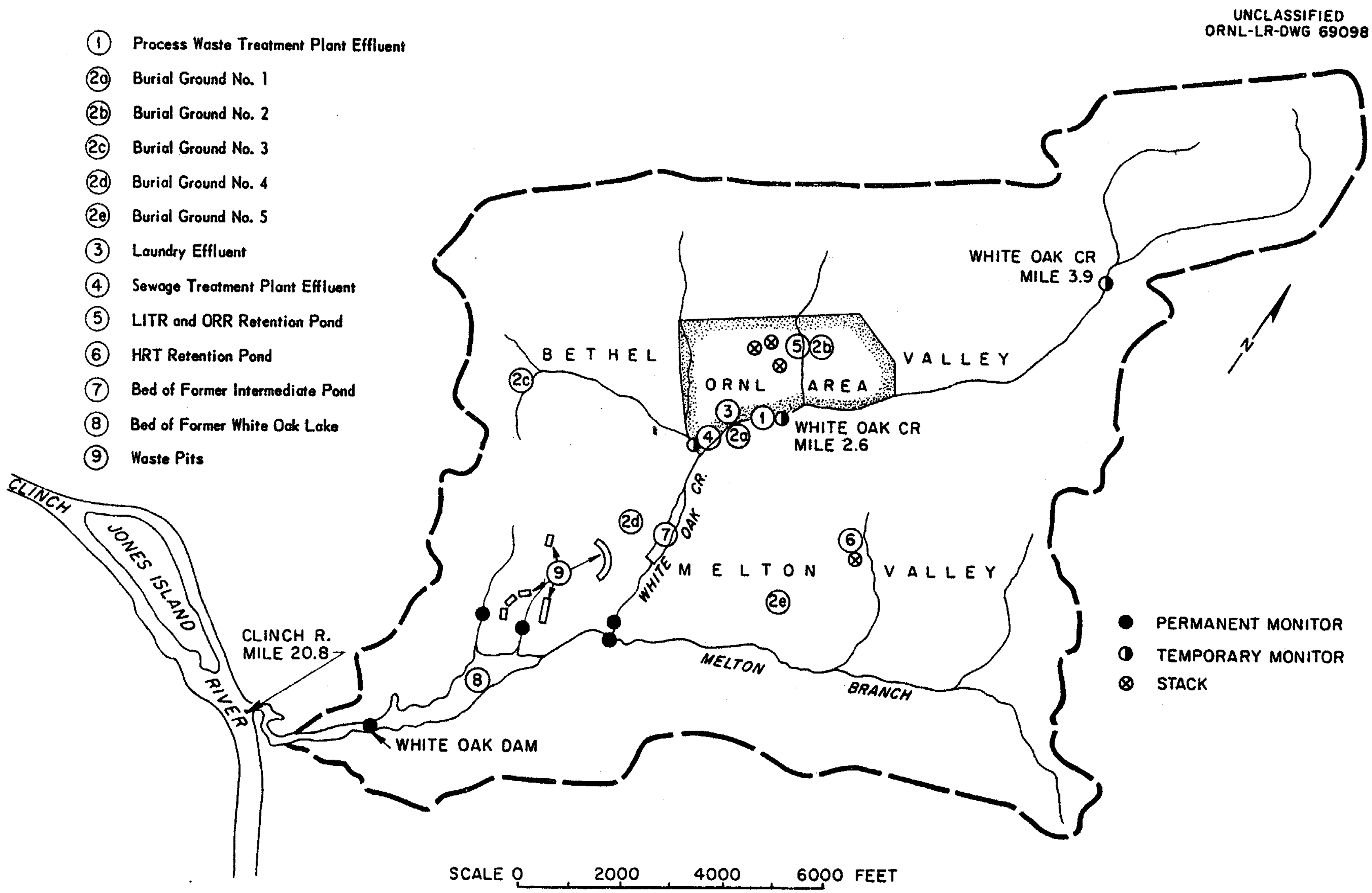


Fig. 1. Map of White Oak Creek Basin
Showing Sources of Radioactive Contamination and Stream-Monitoring Stations

Table 1. Radionuclides Released to White Oak Creek

May - December 1961

	Sr^{90}		Cs^{137}		Co^{60}		Ru^{106}	
	mc	%	mc	%	mc	%	mc	%
Process Waste Water Treatment Plant (PWWTP) a	4200	63.93	1120	50.82	443	.67	416	.01
Sanitary Sewage	197	3.00	37	1.68	7	.01	7	< .01
Laundry	11	.17	22	1.00	8	.01	3	< .01
Watershed Above Northwest Tributary Station	61	.93	31	1.41	1	< .01	11	< .01
Watershed Above Station at WOCM 2.6	170	2.59	187	8.48	94	.14	43	< .01
*Storm Sewer Below PWWTP in Bethel Valley	1135	17.27	127	5.76	208	.31	68	< .01
Watershed Above Melton Branch Station a	782	11.90	205	9.30	289	.43	5207	.07
**Waste Pits a	14	.21	475	21.55	65,000	98.42	6,838,000	99.92
	6570	100.00	2204	100.00	66,050	100.00	6,843,755	100.00

* Values based on quantities detected April - October 1962

** Values represent quantities released from pits.

a Values obtained from Operations Division.

Table 2. Per Cent of Cs^{137} in Liquid and Solid Phase of White Oak Creek Water

Run Number	Flow in Creek (cfs)	Suspended Solid Concentrations (g/liter)	Liquid Phase (%)	Median Diameter of Particles (%)					
				< 9 μ	9 μ	12 μ	19 μ	29 μ	> 250 μ
1	14.4	0.011	71.3	25.7	0.2	1.0	1.3	0.5	< 0.1
2	57.2	0.044	50.7	39.9	0.5	1.8	3.5	2.6	1.0
3	5.5	0.004	58.7	37.7	0.9	1.2	0.3	1.2	< 0.1
4	6.1	0.012	79.5	19.3	0.4	0.4	0.1	0.3	< 0.1
5	5.0	0.010	79.6	18.8	0.5	0.5	0.5	0.1	< 0.1
6	5.3	0.006	77.1	15.9	2.2	1.9	2.2	0.6	0.1
7	7.8	3.261	4.3	85.3	4.0	2.4	2.9	1.1	< 0.1
8	43.5	0.692	3.9	65.4	7.8	5.6	8.7	8.3	0.3

Table 3. Per Cent of Sr^{90} in Liquid and Solid Phase of White Oak Creek Water

Run Number	Flow in Creek (cfs)	Suspended Solid Concentrations (g/liter)	Liquid Phase (%)	Median Diameter of Particles (%)					
				< 9 μ	9 μ	12 μ	19 μ	29 μ	> 250 μ
1	14.4	0.011	99.26	0.61	0.03	0.03	0.04	0.03	< 0.01
2	57.2	0.044	98.09	1.01	0.08	0.17	0.47	0.17	0.01
3	5.5	0.004	99.30	0.55	0.04	0.06	0.01	0.04	< 0.01
4	6.1	0.012	99.63	0.33	0.02	0.01	< 0.01	0.01	< 0.01
5	5.0	0.010	99.43	0.52	0.02	0.02	0.01	< 0.01	< 0.01
6	5.3	0.006	99.50	0.40	0.04	0.03	0.02	0.01	< 0.01
7	7.8	3.261	75.52	18.07	3.36	1.68	1.10	0.27	< 0.01
8	43.5	0.692	92.92	3.94	0.87	0.69	1.06	0.50	0.02

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation

Post Office Box X
Oak Ridge, Tennessee

Distribution Limited
To Recipients Indicated
For Internal Use Only

ORNL
CENTRAL FILES NUMBER
63-3-47

DATE: March 22, 1963

COPY NO. 24

SUBJECT: Waste Effluents Committee Minutes of Meeting Held December 10, 1962

TO: Listed Distribution

FROM: Francois Kertesz

USE OF THIS REPORT IS LIMITED TO RECIPIENTS ONLY UNLESS THE AUTHOR'S PERMISSION IS OBTAINED.

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report. The information is not to be abstracted, reprinted or otherwise given public dissemination without the approval of the ORNL patent branch, Legal and Information Control Department.

OAK RIDGE NATIONAL LABORATORY

LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: December 10, 1962 **Code Number:**

Present:

Members	Experimenters or Operators
R. N. Lyon, Chairman	T. A. Arehart
W. A. Arnold	C. M. Carter
K. B. Brown	R. M. Holmes
F. Kertesz	W. M. Stanley
F. L. Parker	

Flood Conditions at Melton Valley

Stanley, Carter and Holmes presented a review of the Engineering and Mechanical Division's planning group which was requested to consider the effect of the Melton Hill Dam on the waste disposal operations in that area. After having studied the problem by means of an analog computer, tentative recommendations have been submitted to management suggesting to make a choice from the proposed alternates before the dam starts operating next July or August.

At first, it was attempted to evaluate the real effect of the existence of the Melton Hill Dam on the currently used waste disposal methods at White Oak Creek. At present, the river provides a dilution factor between 450 and 500, which is sufficient to keep radioactive discharges in the river below 0.3 of the MPC_W value; actually, the activity was about 28% of MPC_W even during low flow in the river. The nonradioactive discharge reached at most only 1% of the recommended limit.

At present the radioactive discharges flow into the White Oak Creek, whence they pass into the river. When Melton Hill Dam will go into operation, the water will be discharged through the turbines 4 hours per day while during the rest of the day only the normal seepage, about 5 to 10 cubic feet per second, will escape from the dammed-up area; except for this small amount of water, there will be no flow below the dam. Thus, the waste from the White Oak Creek area will reach a stagnant pool. This situation may result in the formation of a concentrated slug which could exceed the maximum permissible concentrations set for the individual materials. In addition, the limits for nonradioactive wastes are expected to be greatly exceeded, e.g., the concentration of detergents might be higher than the permissible level by a factor of 1500. As soon as the generating system is started, a sudden flow of 23,000 cfs will hit this slug, carrying it downstream and forcing some of the activity back into the White Oak Creek embayment. The onrushing flow would stop completely the discharge from the White Oak Creek area. Should the White Oak Dam be opened at that time, the flow could be forced back into White Oak Lake.

It should be kept in mind that the White Oak Dam is designed for zero back pressure. The rush of the water would cause scouring at the downstream

Committee: Waste Effluents Committee
Meeting Date: December 10, 1962
Subject: Flood Conditions at Melton Valley

side; also, the downstream side would have a higher head during this period. Although the back pressure is not expected to damage seriously the structural stability of the dam, the rapid alternating rise and fall of the water would result in the formation of cavities. As a final result, the water would flood the area used at present for ecological studies.

In order to take care of this problem, it is considered necessary to impound the flow of the White Oak Creek during the period during which there is no flow at the Melton Hill Dam. The flow containing the radioactive waste would be discharged only when the Melton Hill Dam discharges its impounded water, thus taking advantage of a dilution factor of 450 as at present. Such a cooperative effort requires the installation of telemetering lines from Melton Hill Dam to the ORNL control station to ensure that the Laboratory will discharge its radioactive waste at the proper rate.

After discussing the problem with N. E. Bolton, the ORNL Industrial Hygienist, and with the UCC waste disposal experts in South Charleston, it was decided to study the dispersion of the waste by means of a scale hydraulic model of the river system. These studies indicated that under the above-mentioned conditions no slug would be formed in the river and the activity would be sufficiently dispersed by the time the liquids reach the intake at the K-25 plant.

The calculations were carried out by making use of TVA data concerning the Watts Bar Lake stages at the 735 and 741 ft. levels. During the summer the Watts Bar 741 ft. level would rise by only 3 feet during the power wave; in the winter this rise of the level could reach about 7.7 ft. On the basis of the simulated river system used in the analog computer studies, and making use of the TVA data, river cross section formulas were worked out and computer diagrams were developed. In the calculations the flood periods involving flow rates of 50,000 cfs were also considered. It was found that the tail waters at the Melton Hill Dam reach the same elevation regardless of how long it takes to open the gates.

Each of the three schemes developed presents certain advantages. The first scheme involves the construction of a piping and spillway area for the purpose of providing discharge control; the proposed drainage structure would allow to empty the flow directly into the river, releasing the 20-hour accumulation. The gates could be designed to operate automatically. In the design of the spillway the normal rainfall was also taken into consideration.

According to the second scheme, the White Oak Dam gate would be closed and a pumping station would provide gravity flow to the river from a storage basin. Although no detailed cost estimates are available at this time, this alternate is considered to be more expensive.

In the third scheme an emergency spillway would be constructed, relocating the pumping station closer to the river, thus reducing the pumping requirements. The hydrostatic head would be between 30 to 40 feet.

These proposals are based on the assumption that it will not be possible to provide outflow from the White Oak Creek embayment during the high flow from the Melton Hill Dam. It would be desirable to determine with certainty whether a slug will be actually formed and carried downstream.

Financing of this construction work and the possible contribution by TVA is a subject for management decision based on the estimated hazard presented by the operation of the Melton Hill Dam.

The designers feel that a slug of liquid will be developed and carried downstream even when the dam is not in operation. It is estimated that it will take about 12 hours for the water from the White Oak Creek to reach the Clinch River. The temperature effect on the formation of the slug is not considered to be noticeable. The most important consideration is that the dilution will not be sufficient to reduce the activity to MPC_w value during the periods during which the dam is closed and the ORNL radioactive waste is released directly to the river.

Although, as mentioned before, no detailed cost estimates have yet been made, Scheme No. 1 is considered to be the cheapest, while Scheme No. 2 appears to cause the least disturbance in the work carried out by the Radioecology Section of the Health Physics Division.

Submitted by Francois Kertesz
Francois Kertesz
Executive Secretary

FK:wc

Appendix

(From a memorandum by W. M. Stanley to Francois Kertesz, dated December 11, 1962.)

Effects of Melton Hill Dam Operations on Waste Discharges From White Oak Creek.

Present Conditions

Average normal flow of White Oak Creek: 10 cfs.

Average flow in the Clinch River: 4,500 cfs.

Average dilution factor: 450 (radioactive waste).

Average MPC of radioactive wastes after dilution: 0.3 or less.

Concentration of nonradioactive wastes after dilution: 1/100 or less of recommended limits.

White Oak Lake Dam gate level: Elevation 741.3.

Normal Clinch River Operating Stages: Summer, elevation 741.0; Winter, elevation 735.0.

Level of White Oak Lake does not interfere with Ecology Study Area in the lake bed.

Future Conditions (Melton Hill Dam in operation)

Average normal flow of White Oak Creek: 10 cfs.

Flow in the Clinch River: Essentially zero flow for 20 hours per day; 23,000 cfs for the remaining 4 hours per day (worst condition - may vary).

Radioactive and nonradioactive wastes will accumulate in an essentially undiluted slug in the Clinch River at the mouth of White Oak Creek during periods of no-flow in the river.

Power release from Melton Hill Dam will raise water levels in the Clinch River, push the concentrated waste slug downstream, and cause a reverse flow in the White Oak Creek embayment. The gates in White Oak Dam, designed for zero back pressure, would have to be opened. This would flood the Ecology Study Area in the lake bed. No outflow from White Oak Creek to the river would occur during this period.

Scouring of the radioactive sediments on the upstream face of the dam would occur.

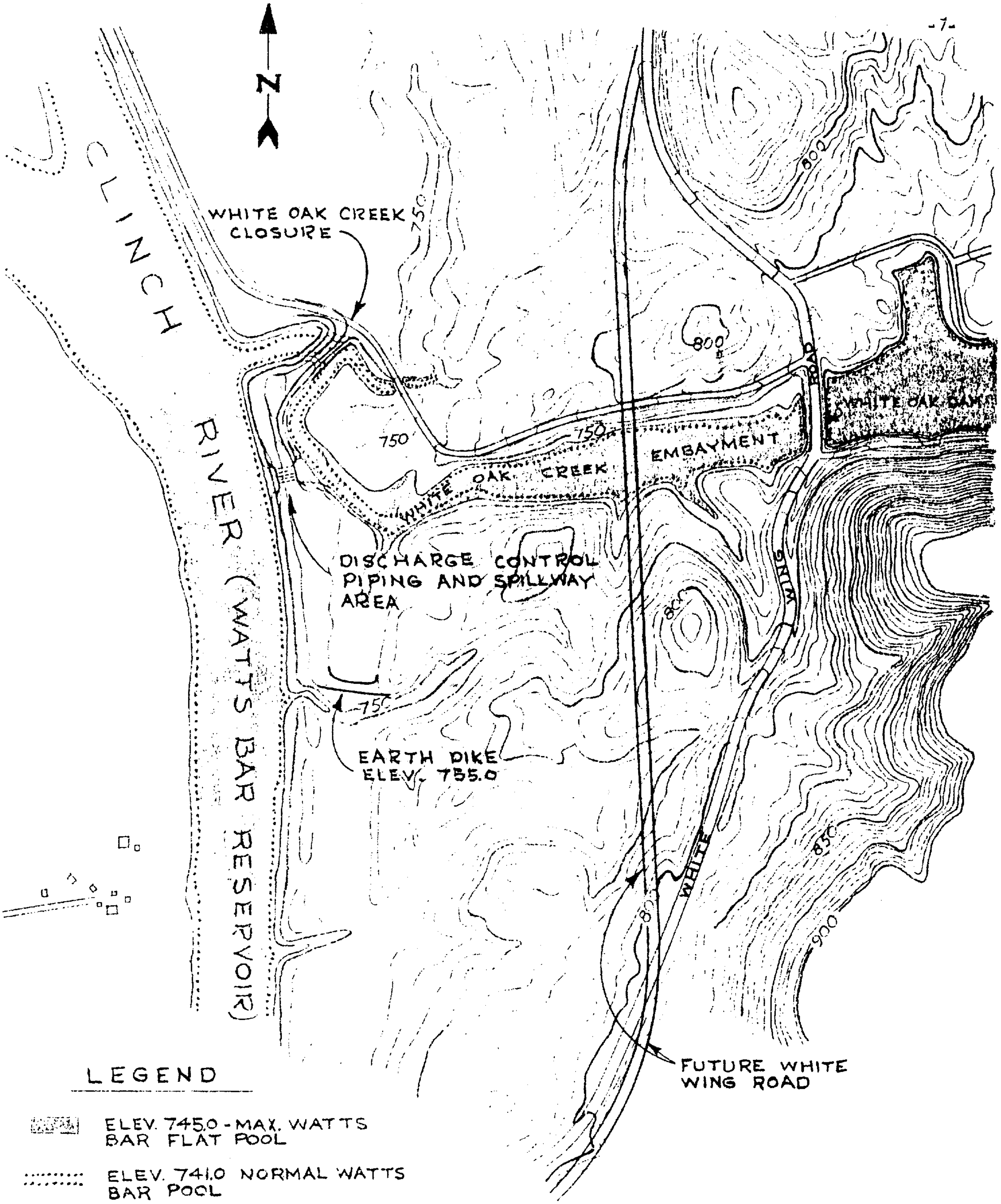
Structural stability of White Oak Dam would not be affected unless rise or fall of the water level is at a rapid rate.

Water levels in the Clinch River, estimated by TVA, would rise 3.5 feet in the summer and 7.7 feet in the winter at the mouth of White Oak Creek.

Computer Analysis of the River System:

The results of an analog computer analysis which simulated the flow system from Melton Hill Dam to river mile 12 are as follows:

Initial Elev.	Q	W.S. Elev. W.O. Creek	Rise (ft)	Avg. Velocity at W. O. Creek	Wave Travel Time R.M. 12
735.0	23,000 cfs	742.1	7.1	3.0 ft/sec.	39.0 min.
737.0	23,000 cfs	742.1	5.7	2.8 ft/sec.	38.0 min.
739.0	23,000 cfs	743.0	4.0	2.7 ft/sec.	36.5 min.
741.0	23,000 cfs	744.4	3.4	2.5 ft/sec.	35.5 min.
743.0	23,000 cfs	745.9	2.9	1.9 ft/sec.	34.5 min.
745.0	23,000 cfs	747.4	2.4	1.8 ft/sec.	34.0 min.
741.0	11,500 cfs	742.2	1.2	1.2 ft/sec.	38.5 min.
741.0	50,000 cfs	751.5	10.5	3.3 ft/sec.	33.0 min.

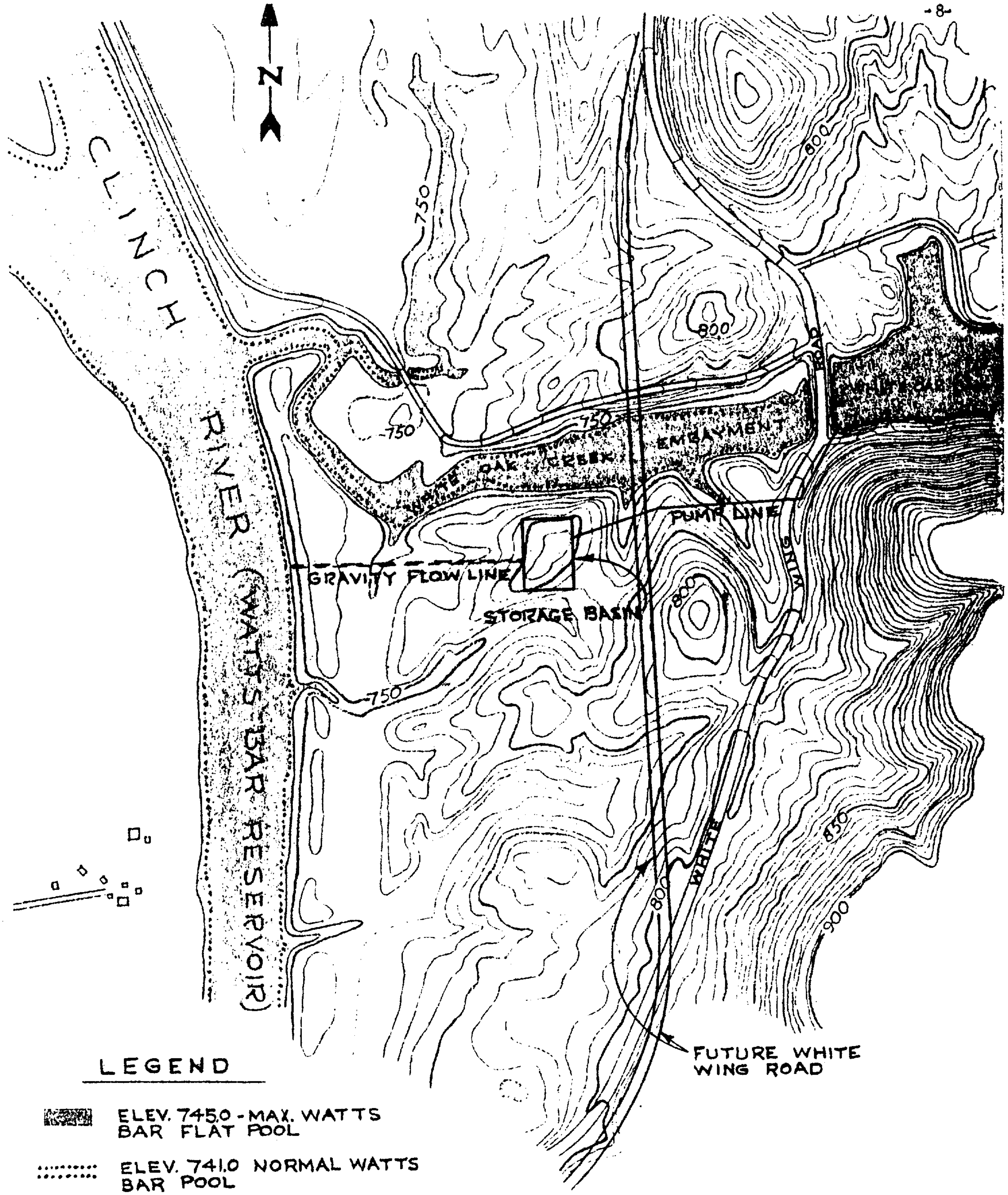


LEGEND

ELEV. 745.0 - MAX. WATTS BAR FLAT POOL

ELEV. 741.0 NORMAL WATTS BAR POOL

FIGURE 1
SCALE: 1" = 500'



LEGEND

ELEV. 745.0 - MAX. WATTS BAR FLAT POOL

ELEV. 741.0 NORMAL WATTS BAR POOL

FIGURE 2
SCALE: 1" = 500'

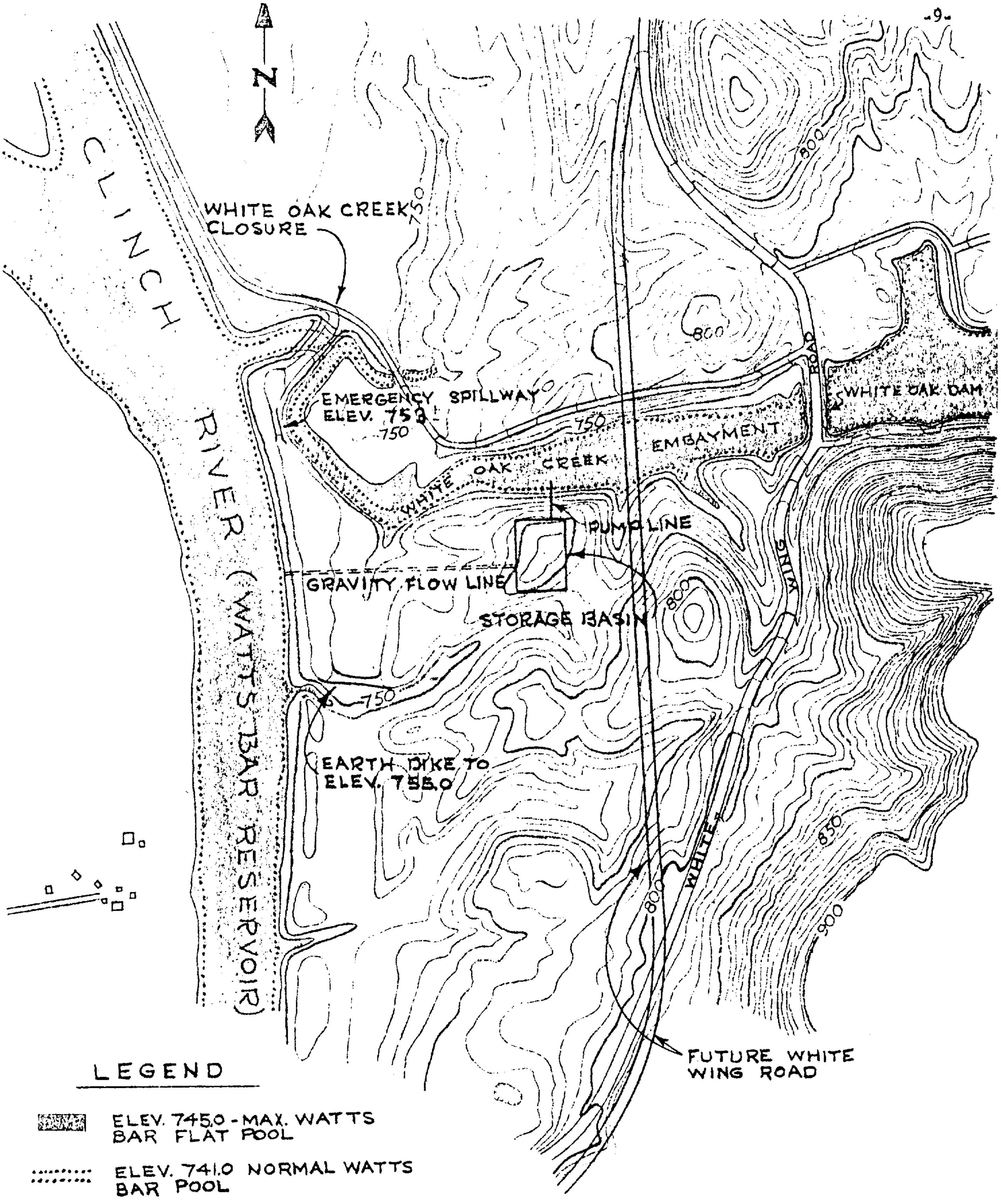


FIGURE 3
SCALE: 1" = 500'

Committee: Waste Effluents Committee
Meeting Date: December 10, 1962
Subject: Flood Conditions at Melton Valley

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. K. B. Brown
6. W. E. Browning
7. F. R. Bruce
8. G. C. Cain
9. S. F. Carson
10. C. M. Carter
11. J. A. Cox

12-15. D. M. Davis

16. R. M. Holmes
17. T. W. Hungerford

18-19. F. Kertesz

20. R. N. Lyon
21. F. L. Parker
22. W. M. Stanley
23. E. G. Struxness
24. W. M. Weinberg-
    J. A. Swartout
25. C. J. Whitmire
26. E. J. Witkowski

27-28. Central Research Library

29. Y-12 Document Reference Section
30. Laboratory Records - RC

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation

Post Office Box X
Oak Ridge, Tennessee

Distribution Limited
To Recipients Indicated
For Internal Use Only

ORNL
CENTRAL FILES NUMBER
63-4-20

DATE: April 10, 1963

COPY NO. 23

SUBJECT: Waste Effluents Committee Minutes of Meeting Held December 3, 1962

TO: Listed Distribution

FROM: Francois Kertesz

USE OF THIS REPORT IS LIMITED TO RECIPIENTS ONLY UNLESS THE AUTHOR'S PERMISSION IS OBTAINED.

NOTICE

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: December 3, 1962 **Code Number:**

Present:

Members	Experimenters or Operators
R. N. Lyon, Chairman	T. A. Arehart
W. A. Arnold	A. F. Rupp
G. C. Cain	W. S. Snyder
F. Kertesz	E. J. Witkowski
F. L. Parker	
E. G. Struxness	

Findings of the Clinch River Study Group

Parker presented a summary of the findings of the Clinch River Study Group. The Applied Health Physics Section surveyed the Clinch River, taking samples of both the water and the sediments. In order to make the data more meaningful, a special Clinch River Study Group was established about three years ago. This group included representatives from TVA, U. S. Geological Survey, U. S. Public Health Service, Tennessee State Department of Public Health, Tennessee State Game and Fish Commission, as well as ORNL and AEC personnel. The scope of the assignment of the group, among others, was: to evaluate safety in the rivers below White Oak Dam in relation to the ORNL waste discharges which might present a potential hazard to the public on the basis of routine discharges (disregarding the potential hazard from major accidents); to determine the fate of radioactive materials in the river, to determine the mechanism of dispersion of the released radionuclides and to evaluate the overall usefulness of the river for radioactive waste disposal purposes, recommending also long-term monitoring procedures. Subcommittees have been established for Water Sampling and Analysis, Bottom Sediment Sampling and Analysis, Aquatic Biology, and Safety Evaluation.

The discharges from ORNL are monitored at White Oak Dam, 0.6 mile above the confluence with the Clinch River. Background samples are taken at the Oak Ridge Water Treatment Plant at CRM 41.5, 20.7 miles above White Oak Creek, and at Loudoun Dam on the Tennessee River, 24.2 miles above the point where the Clinch River enters the Tennessee. The nearest downstream monitoring station is at the ORGDP water plant intake, 6.9 miles downstream; and successive sampling stations are above Centers Ferry, 15.9 miles downstream; Watts Bar Dam, 59.1 miles downstream; and Chickamauga Dam, 118 miles downstream. The major hazardous nuclides found in the water-borne material, both dissolved and particulate, are Ru^{106}, Sr^{90}, Cs^{137}, and Co^{60}. During the years 1949-1961, the major isotopes discharged were ruthenium, 47%; TRE, 14%; Sr^{90}, 12%; Cs^{137}, 6.7%. Mass curves of each of the four major isotopes passing through the Clinch River show that essentially all of the radioactive material discharged over White Oak Dam eventually passes by the Centers Ferry sampling station. For the first year of the test, adjusted results show that 107% of the ruthenium of that discharged passed the downstream station, 110% of the cesium, 89% of the cobalt, and 95% of the strontium. It is obvious that amounts greater than those discharged could not pass the downstream station; so this gives some measure of the order of magnitude of the errors.

Based upon data collected over a number of years by the Applied Health Physics Section, the level of activity measured over the bottom muds appears to reflect almost directly the releases, minus ruthenium, into the Clinch River during the previous years— 1961, 250 curies; 1960, 500 curies; and 1959, 600 curies. There does not appear to be a cumulative buildup. The total nuclide inventory in the sediments is also believed to be quite low. To determine this total inventory, samples were collected two years ago and analyzed. The results showed that variations in the specific activity for each isotope longitudinally are not as great as the variations in specific activity between the different isotopes. As might be expected, cesium had by far the highest specific activity in the sediments and was followed by total rare earths, Ru^{106}, Co^{60}, and Sr^{90}. It was found that the Swedish foil sampler, a piston-type sampler, and available for use only under license, was the best sampler for coring in the Clinch River. The foil sampler uses thin steel foils to insulate the core from the core barrel wall and, thus, reduce the friction between the soil and the sampler. With this device there is little compaction and there is good recovery of the soil sample. The foil sampler was further modified by placing a core catcher in the core barrel and a slit mylar sleeve on top of it in order to retain some of the soupier samples. Core recoveries at the designated locations were 80 to 100%, and cores are now being examined to determine the nuclide distribution with depth and to determine the various gamma emitting isotopes present. In the earlier survey, it was estimated that about 75 curies of radioactive material were stored in the upper layers of the bottom muds between Clinch River Miles 4.7 to 21.5. This is an underestimate because the cores did not sample all the way through the sediments. However, when the present analysis is complete, it will be possible to make an estimate of the total amount of radioactive material stored in the river sediments. An earlier estimate, based on the same earlier survey, assumed that all of the sediment in the river is contaminated to the same extent as the surface sediments and, thereby, computed that the maximum that could be stored in the sediments as a result of releases between mid-1943 and mid-1960 was 1670 curies. This is obviously an overestimate, due to the assumptions made.

The total amounts of Sr^{90} and Cs^{137} discharged to the Clinch River from 1949 to 1961 are 1151 and 654 curies, respectively.

Taking into account the amount of radioactive material released to the stream in the years of this study, the amounts passing through the stream system in these years, and the total amounts accumulated in the bottom sediments since the Laboratory began its operations, only the reservoir of activity in the organic phase is unknown.

An accurate estimate of the inventory in the organic reservoir is almost impossible to obtain, but it is possible to obtain an outside limit of this reservoir by assuming that phosphorus is the limiting factor in the organic matter in the Clinch River as it is in most streams, that all the phosphate in the Clinch River is incorporated into the organic matter, and then that phosphorus on the average is equal to 0.5% of the wet weight of the biomass and the average content of PO_4 in the Clinch River is 0.2 ppm. Then one can postulate that the maximum amount of biomass possible in the river is 1,340,000 lbs. If we assume that the maximum concentration found in fish during the period of the study is the maximum possible (2550 μμc/kg, cesium, and 6700 μμc/kg, strontium, whole fish), then we have a total of 1.6 mc of Cs^{137}, and 4.1 mc of Sr^{90} in the river system; and, even if we assume a concentration factor of 10^6 from the water to the organic matter, which is highly unreasonable, there still would only be an inventory of 6.1 c of Sr^{90} and 3.54 c of Cs^{137} in the organic matter.

On the basis of the work done to date, it is obvious that no catastrophic type release from a river system might result from a flood, drought, or changes in pH or oxidation-reduction potential, and, even if the release swept the river clear of radioactive material, it still could not result in a major accident. This does not mean, of course, that a hazard would not exist, but that its magnitude would be small. Under average conditions more cesium and strontium are contained in the water-borne phase of the Clinch River, about 435 mc of Sr^{90} and 250 mc of Cs^{137}, than in the organic matter, 4.1 mc of Sr^{90} and .6 mc of Cs^{137}.

Though the concentration of radioactive material in Clinch River water is below the ICRP, NCRP, FRC recommendations for drinking water, an analysis is now being made to determine what are the potential hazards and dosages received due to the disposal of the Oak Ridge National Laboratory wastes. The hazards are due to water ingestion, water immersion, fish ingestion, potential ingestion of irrigated foods, exposure to bottom sediments, and exposure from industrial operations where large volumes of water are used. To determine the effect of such ingestion, both the calculated exposure and the measured exposure by whole body counting are being determined. However, because the isotopes of interest that are detectable by whole body counting have short effective half lives - for example a maximum of 70 days for Cs^{137} - only the effect of current ingestion is measured.

In addition, the Study Committee is also investigating the effect of the construction of Melton Hill Dam at CRM 23.1 upon the fate and distribution of radioactive material in the Clinch River. Melton Hill Dam will be operated as a peaking plant and, consequently, will send average peak flows of 23,000 cfs downstream for a few hours per day in the winter season and 9,000 cfs in the summer season. These discharges, of course, can and will vary in response to the amount of water available and the energy demands of the TVA system. The release of 23,000 cfs will cause a water-level rise at White Oak Creek of 3.5 feet in the summer and 7.7 feet in the winter. These releases will, of course, affect the releases of waste from White Oak Dam. If the dam gates are operated at the present setting or even at much higher settings, it will not be possible to discharge the accumulated wastes out of White Oak Lake except when Melton Hill is not discharging. Therefore, the wastes discharged from White Oak Lake will pond in the Clinch River near their confluence until they are carried downstream as a slug by the flow from Melton Hill Dam. In order to investigate the effect of the wave passing through this ponded material, a series of tests were run in the flume of the Geological Survey at the National Bureau of Standards in Washington. Though the data are still being analyzed, it appears that the wave form passing through the contaminated pool will not materially disperse the slug of radioactive material.

For constant use of the river water, this will have no effect, since the total amount of activity moving downstream will still be the same. However, for intermittent use during the times when Melton Hill is not flowing, a greater dosage than presently received can be expected, since one will be using water with higher concentrations of fission products.

The operation of Melton Hill Dam will cause considerable change in the sediment, water-borne, and deposited radioactive material; and, therefore, a further year of study under the new regime is anticipated.

Hazards Discussed and Safeguards Suggested

What is the expected effect of Melton Hill Dam on the activity in the river?

Operation of the dam is not expected to have any direct effect.

What would happen in case of the maximum possible rainfall and flood?

According to the Weather Bureau, the water flow could reach 18,000 cfs at White Oak Dam, causing the level to rise several feet above the dam. In such a case, the dam would probably fail.

What is the activity holdup on the bottom of White Oak Creek?

About 1,200 curies of ruthenium are held by the sediment as of February 1962. Under the present equilibrium conditions the ruthenium stays in the White Oak Lake sediment.

Could the prevailing flow conditions in the system cause difficulties?

It is possible that under certain conditions the water cannot be discharged at the desired rate as the gates are relatively small.

On the basis of available information, how safe are the radioactive discharges from the Laboratory?

Considering the total dosage except for the ingestion of fish, which is currently being studied, the discharges are comfortably on the safe side; however, it should be emphasized that operation of the EGCR introduces a new and probably minor factor.

What is the ultimate fate of the released radioactive strontium, cobalt, cesium and ruthenium isotopes?

The river acts as a giant pipeline in this respect. Everything that is put in comes out ultimately after a certain delay. Cesium and cobalt are difficult to detect; in addition, by the time they reach downstream, certain nuclides might have decayed or been diluted below detectable levels.

What is the ultimate capacity of the river for removing the radioactive waste?

The activity should be considered exactly as an industrial waste. As mentioned before, at present the release is considerably on the safe side; otherwise, discharge of radioactive materials would be forbidden. As to the future, it is estimated that about five-fold increase of the released activity might put the Laboratory in an uncomfortable position.

Could a flood cause a serious emergency?

Flooding is not expected to have serious consequences. Backing up of the waters to White Oak Lake could result in the leaching out of ruthenium, possibly forming a hot slug. However, it is pointed out that the ruthenium is very tenaciously held by the lake bottom deposits. On the other hand, washing out of the dam would present a more serious danger.

Will the construction of the Bull Run Steam Plant interfere with the radioactive waste disposal activities?

Using the river water for cooling purposes by the new steam plant will not seriously change the already present stratification of the water.

Snyder discussed the radioactive waste releases in the White Oak Lake system from the viewpoint of the maximum permissible concentrations, reviewing also the historical development of the MPC concept. The first attempts for defining radiation limits were made at the 1928 conference of the International Commission on Radiological Protection, at which time the problems of radiologists were primarily considered; the "dose" concept did not exist at that time. Later, a dose of 0.2 r/day was adopted, which since 1935 was successively reduced to the present value of 0.1 r/week. National groups were formed to represent their countries at the ICRP; in the United States the National Committee on Radiation Protection was created under the sponsorship of the National Bureau of Standards.

The internal dose was first considered officially in 1941, although some prior evidence was available that radium in the body might cause bone cancer. A maximum permissible body burden of 0.1 microgram of radium was accepted at that time; this value is retained even today for occupational exposure. The changes in the past twenty-five years in the maximum permissible occupational exposure are indicated on Fig. 1.

After the reorganization of the ICRP in 1946, standards were established for the external and internal exposure. It should be remembered that ICRP is only a professional society and its standards have no legal authority. The standards were adopted in many countries and became very important as the use of nuclear energy increased during the last fifteen years. In 1954, the MPC_p values, which were designed to limit exposure of the population, were suggested for use in the neighborhood of nuclear installations.

In view of the importance of the problem of exposure of the population, in 1958 NCRP appointed a committee to study the scientific basis for establishing exposure limits. The committee felt that, excepting a reasonable amount of medical exposure, population exposure should not exceed the average national background without carefully considering the reasons for such exposure, such as benefits to the society as a whole. The level of 100 milliroentgens per year was accepted as the average background. The ICRP has suggested standards which, in essence, are similar. The recommended permissible doses to body organs of occupational workers exposed to ionizing radiation are given in Fig. 2.

The first internal dose values are given in the National Bureau of Standards Handbook 42, published in 1952; since then, detailed values have been established for a large number of isotopes. The experience of medical radiologists might be interpreted to indicate that certain organs may be exposed to even higher radiation levels without harmful effects becoming grossly apparent, i.e., as an easily detectable increase in the normal incidence rates of similar effects. In the meantime, many genetic studies have been made; the results, as evaluated by a committee selected by the

NRC, indicated it would be wise to lower the genetic dose. The present rules require that the average dose should not exceed 5 rem during the genetic life of 30 years, because a higher level of radiation might induce an undesirable, more than two-fold, increase of the mutation rate.

Most mutations have deleterious effects, and many of them are lethal, leading either immediately or at a later time to genetic death. In a ceiling established for the whole population, enough latitude must be left to take into account the future development of the atomic energy industry. Neither of the committees made specific recommendations concerning the maximum permissible somatic dose, although the ICRP has suggested a maximum of 1/10 the occupational level for individuals and also that average dose in the whole population should not exceed 1/30 the occupational level.

The following three population groups have been established for the purpose of estimating the genetic dose that might be received by the population: a) the "occupational" group; b) the "neighborhood-of-a-plant" group; and c) the population at large (Figs. 3 and 4). Since all of these categories of exposure contribute to the total genetic load of the population, the ICRP suggested the following apportionment of potential exposure based on a limit of 5 rem to age 30 years, averaged over the entire population:

Occupational group	- 2 rems
Neighborhood group	- 0.5 rem
Population-at-large	- 1 rem
Special reserve	- 1.5 rems.

These values may be changed as needed by the national bodies, keeping in mind the general guideline of 5 rems for 30 years.

A new group, the Federal Radiation Council, began to function in 1960. Its chief concerns are fallout problems and the coordination of the activities of the various government agencies in the field of radiation protection. To date it has published three reports. In the first report basic exposure limits are given; these limits on the whole-body and genetic dose are essentially the same as those established by NCRP and ICRP. The second report was devoted to internal emitters such as radium, strontium, and iodine-131, considering in particular the special problems involving children. A new method has been developed for calculating the MPC values for bone seekers from the Sr/Ca ratio, resulting in slight changes of the limits by balancing the resultant benefits versus the increased risks. For strontium, the value of 1.5 rem/year in the bone is considered to be an acceptable hazard. Thus the FRC arrived at the same

?

answer as the NCRP, but by a different method. In the third report, the Council gives interpretive guidance for fallout studies. The previously available maximum values have been applied to fallout because no other guidance was available although they were developed, in general, for application to the radiation worker and to neighboring groups of people. All three limit-setting bodies recommend averaging the values for population exposure on an annual basis. For example, in view of the fact that ingested strontium acts throughout the whole lifetime of the individual, it does not matter whether the material is absorbed on one occasion or in smaller doses throughout the year. The total body burden is more significant than the immediate dose rate.

The AEC values of the maximum permissible concentrations are published in the Federal Register and have the force of law; the FRC acts as advisor to the President and does not issue formal regulations directly. The rules are usually issued over the President's signature, and although they do not represent Federal law, they are binding on Federal agencies. Of special importance for application to ORNL waste management is the maximum permissible concentration of strontium, 10^{-6} microcuries/milliliter for occupational exposure and 10^{-7} microcuries/milliliter for the exposure of the neighboring population. If the average exposure of the most exposed group is one-third below the recommended level, it is assumed that the requirements are met. The primary standard is the body burden accumulated by the individual; however, the maximum permissible concentrations or the daily or the yearly intake may be used as secondary standards. Occupationally, this value is computed by the quarter.

For a mixture of several nuclides, the total activity ΣA_i is controlled according to the formula

$$\left(\Sigma \frac{A_i}{(MPC)_w^i} R\right) \leq R,$$

where R is the permissible dose rate to the critical organ. The activity A_i in water is averaged over a year. The $(MPC)_w$ values are those for population exposure and are generally taken as 1/30 of the occupational values. For the purposes of this calculation, it is assumed that all the nuclides irradiate the same organ. For an unknown mixture of β-emitters, the smallest $(MPC)_w$ for β-emitters would be used, and this value might be less than that for strontium-90. As a general rule, the smallest MPC value for a given radionuclide is used in these calculations, and then the assessment applies for all organs of the body. On the basis of the above, strontium generally is found to be the controlling factor although its contribution to the total activity is relatively low.

Committee: Waste Effluents Committee
Meeting Date: December 3, 1962
Subject: Findings of the Clinch River Study Group

Hazards Discussed and Safeguards Proposed

Is the amount currently released to the river considered to be hazardous?

No; the level that is released is considered safe and legally acceptable as long as the MPC_w values are not changed.

Has the MPC value been reached at the Laboratory?

Only in a very few cases has the MPC level been reached in the river, and then only briefly. Of course it should be kept in mind that the determination of the MPC is not easy. Also the interpretation of any resulting dose is difficult. In the case of the radium watch dial painters, the body burden was checked after a long period of time; the original intake was probably considerably higher than the amount found at the time of measurement. At present, it is not known whether the peak dose or the total dose causes cancer.

What is the correlation between radium body burden and exposure?

0.1 microgram of radium corresponds approximately to 30 rems per year averaged in the skeleton.

Has a definite correlation been established between a dose and a shortening of life?

The statistics based on radiologists do not indicate a definite shortening of life although a higher incidence of leukemia was found and the exposure was roughly estimated to be between 5 and 50 rem/yr.

Have other population groups been checked?

Data are available on miners in Canada, United States, and Czechoslovakia, but this group is not large enough to fulfill all statistical requirements. These people were exposed to an estimated 15 rems per year or more to the lung and presented an increased death rate from lung cancer. In establishing the limits for radon-222, it seems best to stay below the figure of 15 rems per year by an as-yet-undefined factor. The bronchus seems to receive a somewhat higher dose.

Committee: Waste Effluents Committee
Meeting Date: December 3, 1962
Subject: Findings of the Clinch River Study Group

Are there any problems concerning the Laboratory's disposal practice?

Although the Laboratory's practice is considered safe and conservative, some problems might arise in the future. The Clinch River study did not reveal any cause for alarm; a temporary situation might cause some embarrassment, but no serious hazard, for the population at large.

Why should attention be focused on improving the radioactive waste disposal?

It is relatively unimportant to reduce further the 1/30 value to 1/100; new information on metabolic factors might affect the situation more strongly; e.g., rad for rad, strontium is more damaging than radium.

Is the situation at the solid waste burial ground considered to be satisfactory?

The exact contribution from the burial ground is unknown; it seems low at present, but it could become more significant in the future if the containers corrode through.

<u>Documents Submitted</u>:

Status Reports on Clinch River Study, R. J. Morton, Editor:

No. 1 - ORNL-3119, July 27, 1961

No. 2 - ORNL-3202, March 30, 1962

No. 3 - ORNL-3370, November 21, 1962.

Submitted by Francois Kertesz
Francois Kertesz
Executive Secretary

FK:wc

UNCLASSIFIED
ORNL-LR-DWG. 43195

CHANGES DURING THE PAST 25 YEARS IN THE MAXIMUM PERMISSIBLE OCCUPATIONAL EXPOSURE[a] OF THE TOTAL BODY TO IONIZING RADIATION

RECOMMENDED RATE[a]	COMMENTS
0.2 r/d (or 1r/wk)	RECOMMENDED BY ICRP IN 1934 AND CONTINUED IN WORLD WIDE USE UNTIL 1950.
0.1 r/d (or 0.5 r/wk)	RECOMMENDED BY NCRP ON MARCH 17, 1934 AND CONTINUED IN USE IN U.S. UNTIL 1949.
0.3 rem/wk	RECOMMENDED BY NCRP MARCH 7, 1949 AND ICRP IN JULY 1950 AND CONTINUED IN USE UNTIL 1956.
5 rem/yr (or 0.1 rem/wk)	RECOMMENDED BY ICRP IN APRIL 1956 AND NCRP ON JANUARY 8, 1957

[a] VALUES GIVEN ARE IN ADDITION TO DOSES FROM MEDICAL AND FROM BACKGROUND EXPOSURE.

Fig. 1

UNCLASSIFIED
ORNL-LR-DWG. 43199A

PRESENTLY RECOMMENDED PERMISSIBLE DOSE[a] TO BODY ORGANS OF OCCUPATIONAL WORKERS EXPOSED TO IONIZING RADIATION

BODY ORGAN	MAXIMUM RBE DOSE IN ANY 13 WEEKS (rem/13 wk)	AVERAGE RBE DOSE IN ONE YEAR (rem/yr)	ACCUMULATED RBE DOSE TO AGE N (rem)
BLOOD FORMING ORGANS	3(ICRP, NCRP)	5(ICRP, NCRP)	5(N-18); (ICRP, NCRP)
TOTAL BODY	3(ICRP, NCRP)	5(ICRP, NCRP)	5(N-18); (ICRP, NCRP)
HEAD AND TRUNK	3(NCRP)	5(NCRP)	5(N-18); (NCRP)
GONADS	3(ICRP. NCRP)	5(ICRP, NCRP)	5(N-18); (ICRP, NCRP)
LENSES OF EYES	3(ICRP, NCRP)	5(ICRP, NCRP)	5(N-18); (ICRP, NCRP)
SKIN	8(ICRP)	30(ICRP)	30(N-18); (NCRP)
	6(NCRP)	30(NCRP)	30(N-18); (NCRP)
		10(NCRP)	10(N-18) (NCRP)
THYROID	8(ICRP)	30(ICRP, NCRP)	30(N-18); (NCRP, ICRP)
FEET, ANKLES	20(ICRP)	75(ICRP, NCRP)	75(N-18); (NCRP, ICRP)
HANDS AND FOREARMS	25(NCRP)		
BONE	30/4n (ICRP, NCRP)	30/n (ICRP, NCRP)	30/n (N-18) (NCRP, ICRP)
OTHER SINGLE ORGANS	4(ICRP)	15(ICRP, NCRP)	15(N-18); (NCRP, ICRP)

[a] VALUES GIVEN ARE IN ADDITION TO DOSES FROM MEDICAL AND FROM BACKGROUND EXPOSURE.

Fig. 2

UNCLASSIFIED
ORNL-LR-DWG. 43197

PRESENTLY SUGGESTED PERMISSIBLE DOSE[a] TO BODY ORGANS OF POPULATION AT LARGE

BODY ORGAN	MAXIMUM VALUES			AVERAGE VALUES		
	rem/yr	rem/30 yr	rem/wk	rem/yr	rem/30 yr	rem/wk
THYROID AND SKIN	3	90	0.06	1	30	0.02
BONE	3/n	90/n	0.06/n	1/n	30/n	0.02/n
GONADS AND TOTAL BODY	0.5	15	0.01	0.17	5	0.003
BLOOD FORMING ORGANS LENSES OF EYES	0.5	15	0.01	(0.17)	(5)	(0.003)
OTHER ORGANS	1.5	45	0.03	0.5	15	0.01

[a] VALUES GIVEN ARE IN ADDITION TO DOSES FROM MEDICAL AND FROM BACKGROUND EXPOSURE.

Fig. 3

UNCLASSIFIED
ORNL-LR-DWG. 43277

PERMISSIBLE GENETIC DOSE TO THE POPULATION-AT-LARGE
SUGGESTED BY THE ICRP TO SERVE AS A GUIDE

(RBE DOSE IN rem TO AGE 30)

(4.5 MEDICAL)*	2.0	1.5 INTERNAL 0.5 EXTERNAL 2.0 GENERAL TO POPULATION-AT-LARGE
5.0 OTHER		
(4.5 BACKGROUND)*	3.0	1.0 OCCUPATIONAL 0.5 SPECIAL GROUPS 1.5 RESERVE
14 TOTAL	5.0	3.0

*THE MEDICAL AND BACKGROUND VALUES ARE PROBABLE AVERAGE VALUES IN THE U. S. AND ARE NOT VALUES SPECIFICALLY RECOMMENDED BY THE ICRP.

Fig. 4

Committee: Waste Effluents Committee
Meeting Date: December 3, 1962
Subject: Findings of the Clinch River Study Group

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. K. B. Brown
6. W. E. Browning
7. F. R. Bruce
8. G. C. Cain
9. S. F. Carson
10. J. A. Cox
11-14. D. M. Davis
15. T. W. Hungerford
16-17. F. Kertesz
18. A. F. Lyon
19. F. L. Parker
20. R. M. Rupp
21. W. S. Snyder
22. E. G. Struxness
23. A. M. Weinberg-
    J. A. Swartout
24. C. J. Whitmire
25. E. J. Witkowski
26-27. Central Research Library
28. Y-12 Document Reference Section
29. Laboratory Records - RC

2374

OAK RIDGE NATIONAL LABORATORY
Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation

Post Office Box X
Oak Ridge, Tennessee

Distribution Limited
To Recipients Indicated
For Internal Use Only

ORNL
CENTRAL FILES NUMBER
63-4-34

COPY NO. 27

DATE: April 11, 1963

SUBJECT: Waste Effluents Committee Minutes of Meeting Held December 17, 1962

TO: Listed Distribution

FROM: Francois Kertesz

USE OF THIS REPORT IS LIMITED TO RECIPIENTS ONLY UNLESS THE AUTHOR'S PERMISSION IS OBTAINED.

OAK RIDGE NATIONAL LABORATORY
LABORATORY DIRECTOR'S REVIEW COMMITTEES

Committee: Waste Effluents Committee

Meeting Date: December 17, 1962 **Code Number:**

Present:

Members	Experimenters or Operators
R. N. Lyon, Chairman	
W. A. Arnold	
K. B. Brown	
G. C. Cain	
F. Kertesz	
F. L. Parker	

Chairman Lyon announced that the Committee reached the point of preparing its final recommendations to management on the liquid waste disposal practices of the Laboratory. As a result of the sessions held during these past few months a considerable body of information has been assembled enabling the Committee to discover weaknesses in the present practices. As a general rule, the White Oak Creek liquid waste disposal system, which includes process waste and other sources of contamination, appears to be well monitored. The recent releases are summarized in the attached tables and charts.

The first question to decide is the ultimate aim of the disposal system in terms of activity control. The fractional MPC_w values of the river water at various points are computed by Applied Health Physics Section; in addition to activity measurements of the river water up- and downstream from the release point, water at White Oak Dam is analyzed also by chemical and γ-ray analysis methods. The 168-hour week composite MPC_w values were calculated on the basis of the White Oak Dam discharges and flow rate in the Clinch River. It should be kept in mind that the ultimate goal of the Laboratory is to provide for radioactive liquid waste disposal, a capability for assuring that the activity of the liquid wastes do not exceed, at the point where they leave the controlled area, one-tenth of the occupational maximum permissible concentration, or 10^{-7} μc/cc. This requirement had to be relaxed for the time being. However, the Laboratory approaches the 40-hour-week occupational MPC_w value within an order of magnitude; in June 1962 it was about 40% and in August 1962 about 7% of MPC_w (without considering the radioiodine). The situation could be improved considerably if it would be possible to remove the ruthenium contamination by eliminating the pits and trenches and by removing the strontium from the processed waste plant effluent and by isolating the other sources. If the creek could be allowed to reach the 40-hour MPC_w level it would be possible to concentrate on areas where this goal is in jeopardy. It should be emphasized that the Laboratory is still in a good position from the viewpoint of satisfactorily safeguarding the public health; the present radioactive waste release is of concern only with respect to public relations.

Cain pointed out that Operations personnel would like guidance from this Committee to set up criteria when to send the waste stream to the pond and when to the treatment plant. In Lyon's opinion the 4500 complex which contributes 64% of the total volume to the process waste is the best candidate for improvement. The saving in chemicals when the streams bypass the plant is negligible; the analytical expenses are actually higher than raw material requirements. The ponds are preferable to the plant because they represent reserve storage facility; it appears to be less expensive to build monitoring ponds than to enlarge the treatment plant.

The origin of the activity shown in Chart 3* is a very important consideration. It indicates that ruthenium is a larger source for the activity than strontium. However, if the Melton Hill area is flooded the adsorption would not be feasible.

The various proposals for taking care of the waste during the period of no release at Melton Hill were discussed. Parker mentioned the settling of particles in the damned up area according to Scheme No. 1.** A 60-in. diameter pipe line would be acceptable to carry the waste stream to the river. The strontium contamination sources must be retained within the Laboratory's control. If the pits and the trenches are removed from use, the strontium activity will ultimately decay away. The strontium balance in the White Oak Creek depends on many factors. In some months a larger amount of activity is removed than is sent into the creek. As a general rule the input is decreasing.

Scheme No. 2,** which requires a dam above the 740 ft. level, involves an earth fill of 20,000 cubic yards at $0.3 to $1 per cubic yard. The pipe lines required in both Schemes 2 and 3** are more expensive than the dam. The differences between Schemes Nos. 2 and 3 are not obvious; but a decision can be made probably on a financial basis, Scheme No. 3 appearing to be cheaper. In both cases no water would flow over the dam except in case of emergency, which is expected to occur about once in every ten years. In both cases the present White Oak Dam gate must be redesigned to be able to take care of back pressure.

The waste treatment plant capacity would be acceptable. The proposed pond for the 4500 complex would improve the situation considerably, assuming that the stream would not oscillate suddenly. This pond would also provide additional capacity for emergency or for changes in the program. The other sources of contamination should be checked individually, taking the analytical costs into account.

---

* See Minutes of Meeting held October 29, 1962.

** See Minutes of Meeting held December 10, 1962.

The Committee noted the excellent cooperation between the Health Physics and Operations Divisions. The Engineering and Mechanical Division is currently checking the buried pipe lines hoping to be able to provide exact maps for their location.

Pending Business

It is noted that the Committee requested information on the present status and the hazards presented by the Gunite tanks; this hazards evaluation report has not been yet received. A procedure for the emergency impoundment basin has been worked out. This basin is to be used whenever the waste stream reaches 25-curie level.

The feeling was expressed that the industrial waste problem may be more important than the radioactive contamination. The final recommendations will be formulated at the time of the next meeting of this Committee.

Submitted by Francois Kertesz
Francois Kertesz
Executive Secretary

FK:wc

Table I

Monthly Discharge From Process Waste Treatment Plant To White Oak Creek

Month 1962	Volume 10^6 gal.	Sr^{90} MPC = 0.015 c/10^6 gal. Curies	% MPC	$Ru^{103,106}$ MPC = 1.14 c/10^6 gal. Curies	% MPC	Co^{60} MPC = 3.8 c/10^6 gal. Curies	% MPC	$C_s{}^{137}$ MPC = 1.5 c/10^6 gal. Curies	% MPC	TRE MPC = .50 c/10^6 gal. Curies	% MPC	TOTAL Curies	% MPC
June	14.4	0.2	93%	< 0.1	< 0.6%	< 0.02	< 0.04%	0.05	0.23%	0	0%	< 2.5	< 93.9%
July	15.8	0.6	253%	< 0.1	< 0.6%	< 0.03	< .05%	0.05	< 0.2 %	0.6	7.6%	< 1.4	261%
Aug.	16.2	0.2	82%	0	0	0.03	.05%	< 0.1	< 0.4 %	0	0%	< 0.4	< 83%
Sept.	14.1	0.2	95%	< 0.1	< 0.6%	< 0.02	< 0.04%	< 0.1	< 0.5 %	0.0	0%	< 0.4	< 96.2%
Oct.	14.8	0.2	90%	< 0.1	< 0.6%	0	0 %	< 0.1	< 0.5 %	0.0	0%	< 0.4	< 91.1%

MPC values are computed from values on pages B-1 to B-6 of ORNL "Radiation Safety and Control Pocket Manual", June 1, 1961. Rare earth values refer to cases when Sr, I, Pb, Po, At, Ra, Ac, Pa, and Th are not present, and converted to 40-hour per week exposure.

Table II

Discharge of Activity From White Oak Lake

(Flow is assumed to average ~ 10 cfs or 200 x 10^6 gallons per month.)

Month 1962	Sr^{90} MPC = 3 c/mo.		Ru^{106} MPC = 228 c/mo.		Cs^{137} MPC = 300 c/mo.		Other (Unknown) * MPC = 0.240 c/mo.		Total		
	Curies	% MPC	Curies	% MPC	Curies	% MPC	Curies	% MPC	Curies	% MPC Known	Total % MPC *
June	1.3	43%	96	42%	1.1	0.37%	2.6	1084% (4%)	101	85%	1165% (89%)
July	1.1	36%	95	41%	1.1	0.37%	2.8	1168% (4.5%)	100	77%	1245% (82%)
Aug.	0.2	6.7%	16.5	7%	0.4	0.13%	1.8	750% (2.8%)	18.9	13.8%	764% (16%)
Sept.	0.9	30%	58.4	26%	.9	0.3 %	3.4	1418% (5.3%)	63.6	56%	1474% (61%)
Oct.	0.6	20%	42.7	18.7%	0.4	0.13%	1.7	708% (2.8%)	45.4	39%	747% (42%)

* MPC for the unknown activity is taken as 3 x 10^{-7} μc/cc. This is unnecessarily conservative and results in the startlingly high figures for % MPC involving unknown activity. If I^{129}, Pb^{210}, Ra^{223}, Ra^{226}, Ra^{228} and Th are not present, the MPC is .33 c/10^6 gal. or 66 c/mo. The % MPC is given by the values in parentheses.

Table III

Three Major Sources of Radioactivity in White Oak Creek

(Based on average creek flow of 200 x 10^6 gal. per month)

Month 1962	Ru^{106} From Trenches and Pits (MPC = 228 c/mo.)	Sr^{90} Seepage MPC = 3 c/mo.	Sr^{90} From Process Waste MPC = 3 c/mo.	Total of Three
June	1.6 x MPC	0.03 x MPC	0.07 x MPC	1.7 x MPC
July	2.4 x MPC	0.0 x MPC	0.2 x MPC	2.6 x MPC
Aug.	1.8 x MPC	0.17 x MPC	0.07 x MPC	2 x MPC
Sept.	2.1 x MPC	0.13 x MPC	0.07 x MPC	2.3 x MPC
Oct.	1.8 x MPC	0.10 x MPC	0.07 x MPC	2.0 x MPC

MPC taken as occupational $(MPC)_w$ for 40-hour week.

UNCLASSIFIED
ORNL-LR-DWG 78997

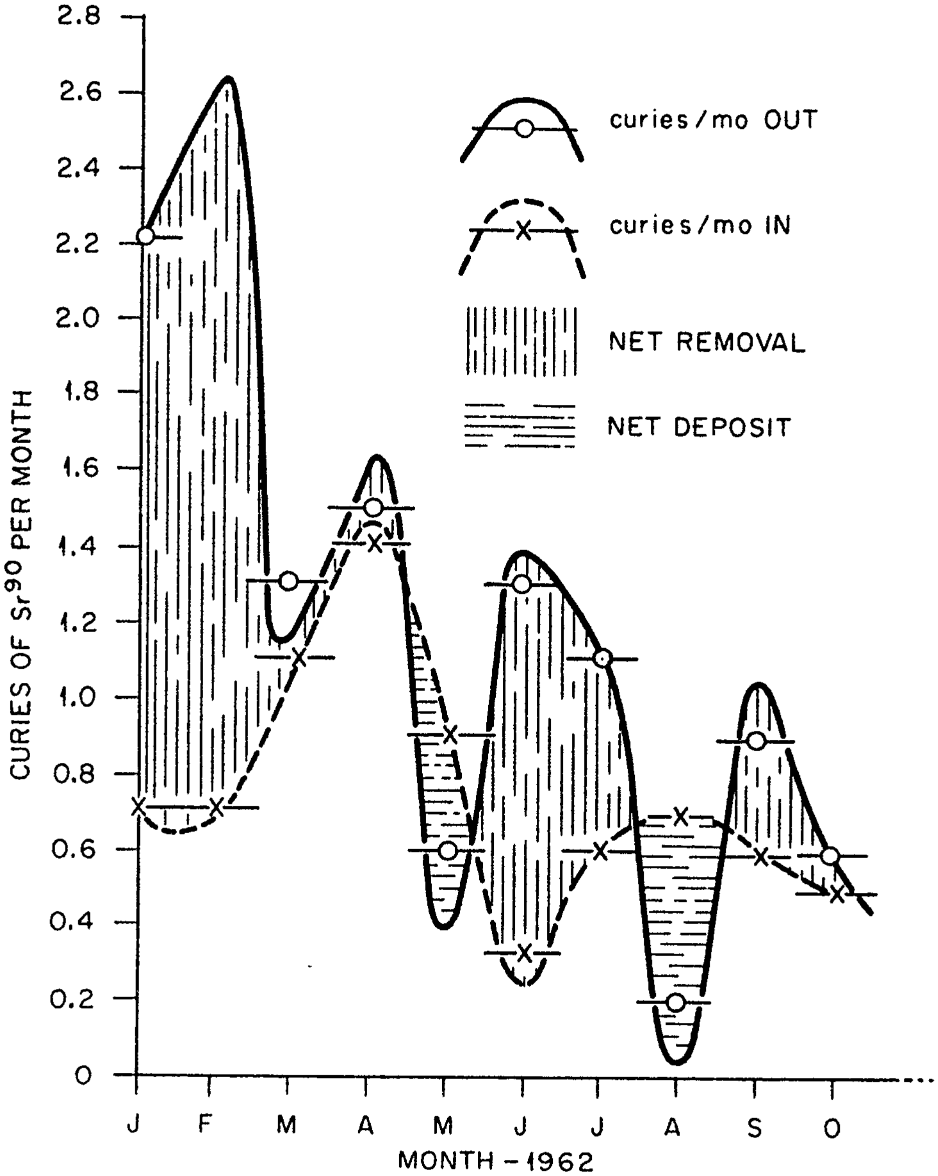


Fig. 1. Sr^{90} Balance on White Oak Lake

UNCLASSIFIED
ORNL-LR-DWG 78998

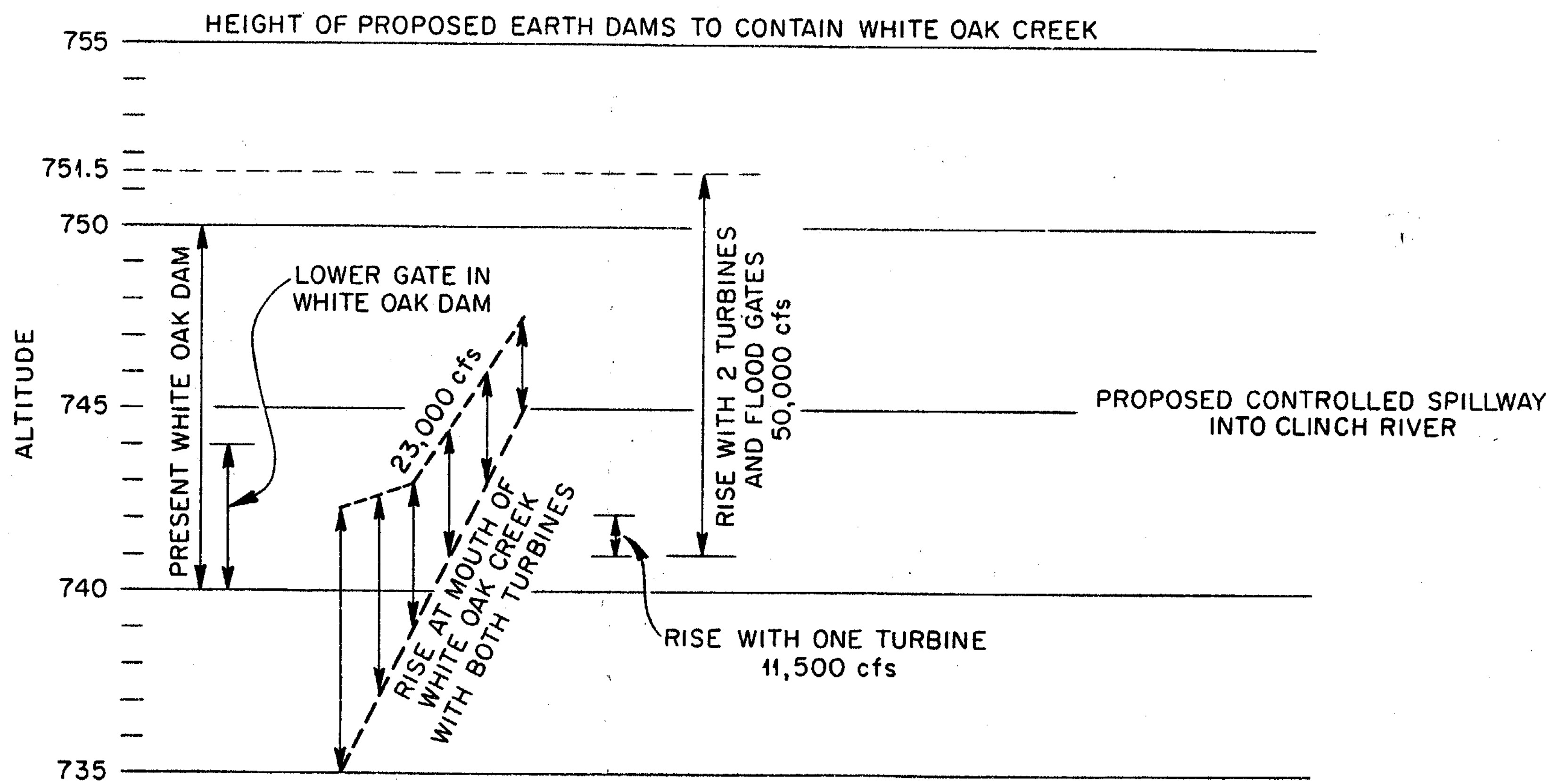


Fig. 2. Elevations of White Oak-Watts Bar System with Melton Hill Dam in Operation.

UNCLASSIFIED
ORNL-LR-DWG 78999

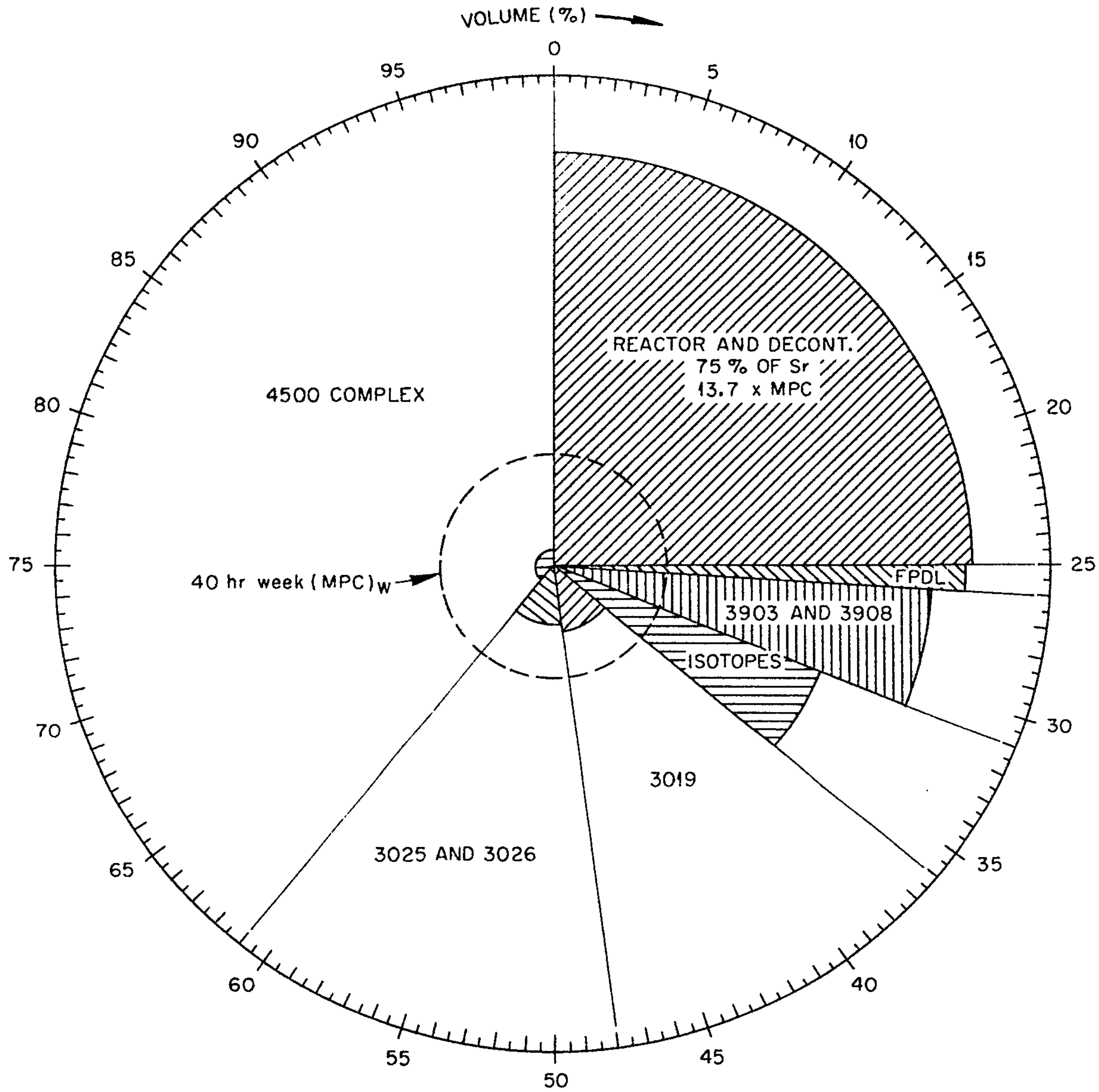


Fig. 3. Process Waste for July 1962.
Shaded Area Proportional to Fraction of Activity Contributed by that Source.

Committee: Waste Effluents Committee
Meeting Date: December 17, 1962
Subject:

Distribution:

1. T. A. Arehart
2. W. A. Arnold
3. S. E. Beall
4. F. T. Binford
5. K. B. Brown
6. W. E. Browning
7. F. R. Bruce
8. G. C. Cain
9. S. F. Carson
10. J. A. Cox

11-14. D. M. Davis

15. T. W. Hungerford

16-17. F. Kertesz

18. R. N. Lyon
19. F. L. Parker
20. E. G. Struxness
21. A. M. Weinberg-
    J. A. Swartout
22. C. J. Whitmire
23. E. J. Witkowski

24-25. Central Research Library

26. Y-12 Document Reference Section
27. Laboratory Records - RC

Committee
Waste Effluents

FRB

Whatever ...
on these ...
— RS

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

February 1, 1963

To: A. M. Weinberg

From: R. N. Lyon

Subject: Activities of the Waste Effluents Committee in 1962

The Waste Effluents Committee in 1962 has concentrated its attention on the radioactive water released to the Clinch River from White Oak Lake, and the sources of the activity in that water. A rough draft of a more complete report on the Committee's findings has been completed and reviewed by the Committee; it will be sent to you shortly.

The activity release to the River during 1962 was less than in 1961, and it appears that further reduction will occur in 1963. After dilution by the Clinch, the activity averaged well below the $(MPC)_w$ for areas in the neighborhood of nuclear plants.

Only a small part of the activity (based on permissible concentrations for individual isotopes) stems from current releases by the waste treatment plant; considerable strontium-90 enters the stream from contaminated storm sewers. Additional Sr^{90} enters from contaminated ground water, by desorption or resuspension from the mud in the creek, and from unknown sources one of which may be fallout on the watershed. As it enters White Oak Lake, the creek water contains more hazard from ruthenium-106 than from strontium. The source of the ruthenium is seepage from the intermediate waste pits and trenches. Fortunately, much of the ruthenium is adsorbed on the lake mud where it decays. The remainder enters the river at about the same fraction of its minimum permissible concentration as the strontium-90.

Major Recommendations

1. The intermediate waste evaporator should be put into operation as soon as possible, and use of the waste pits and trenches should be discontinued.* Further,

*The first part of recommendation #1 has been urged by the Committee for several years.

each pit and trench and its surrounding terrain and geology should be studied individually by Health Physics and E&M to determine the best method of preventing water from entering it as direct rainfall, as surface runoff or as ground water. Because of the long-lived cesium and strontium in the pits and trenches, they must be protected for hundreds of years.

2. The Engineering and Mechanical Division should be given funds and a directive to locate and trace all active and abandoned sewers and waste lines which may be contaminated. These not only represent a major source of Sr^{90}, but ignorance of their location prevents drilling wells to sample ground water, particularly around the concrete intermediate waste tanks. E&M should be supplied with mine detectors, gravity meters, or any other devices which will permit them to carry out the location, tracing and mapping of the lines as efficiently as possible.

3. The Laboratory should be prepared to build dikes to impound White Oak Creek below the lake so flow into the river can be limited to those times of the day when TVA is releasing water through Melton Hill Dam. It may also be necessary to pump water over White Oak Dam to continue to benefit from the adsorption of Ru^{106} on the lake mud and to prevent destruction of the ecology study area. White Oak Dam itself may need improvement to withstand fluctuating levels on its downstream face. A current study by the Operations Division to determine the steps required by the presence of Melton Hill Dam is scheduled for completion by early March.

4. Operations Division should continue to track down sources of activity in the process waste, and the people responsible for the sources should be assisted in reducing or eliminating the activity in their process waste.

5. Holdup ponds should be constructed for the process waste from the 4500 Building and when analysis shows the waste in a pond to be sufficiently low in activity (see recommendation #9) the water should be dumped directly into the creek and not put through the waste treatment plant.

6. A hazards report should be written by the Operations Division on the Gunite waste tanks, and proposals should be made for examining their contents, condition, and integrity.*

---

*Recommendation 6 has been urged by the Committee for several years, and recommendation 7 was made by the Committee last year.

7. The proposed procedures for use of the 3 million gallon Emergency Pond should be published by the Operations Division for review by all concerned groups.

8. Data on the monthly flows in White Oak Creek and the Clinch River, principle isotope concentrations, composite MPC and % MPC should be circulated to all concerned groups in the Laboratory.

9. Health Physics should determine and notify the Operations Division of the maximum permissible concentration of radioisotopes which may be put directly into the creek.

Submitted by R. N. Lyon

R. N. Lyon, Chairman

RNL:bw

cc: W. A. Arnold
S. E. Beall
K. B. Brown
F. Bruce
G. C. Cain
J. A. Cox
D. Davis
F. Kertesz
H. G. MacPherson
H. F. McDuffie
K. Z. Morgan
H. E. Seagren
E. G. Struxness
J. A. Swartout
E. Witkowski